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INSIDE THE CRYSTAL PALACE: A HISTORY OF HENRY FORD'S HIGHLAND PARK PLANT

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# INSIDE THE CRYSTAL PALACE:
# A HISTORY OF HENRY FORD'S HIGHLAND PARK PLANT

By

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## ABSTRACT

INSIDE THE CRYSTAL PALACE:
A HISTORY OF HENRY FORD'S HIGHLAND PARK PLANT

BY

April Kay Jacques

This thesis is dedicated to Henry Ford's Highland Park factory, which is still standing in Highland Park, Michigan today. While many works of scholarship have touched upon Highland Park, none have been written entirely devoted to this site alone. This thesis has been written to bring back to life this important example of early 20th century automotive architecture and to highlight its place among the great structures that have changed our world. This thesis has focused on five major themes in the history of Highland Park: The development of the Ford Motor Company and the automotive industry, the new industrial ideas and techniques developed at Highland Park, the role of Henry Ford himself in the development of the Highland Park complex and its innovations, the innovative architectural designs and techniques used to build Highland Park and the revolutionary services offered to employees at Highland Park throughout its history.

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# INTRODUCTION

# Introduction
## A Cornfield and a Dream

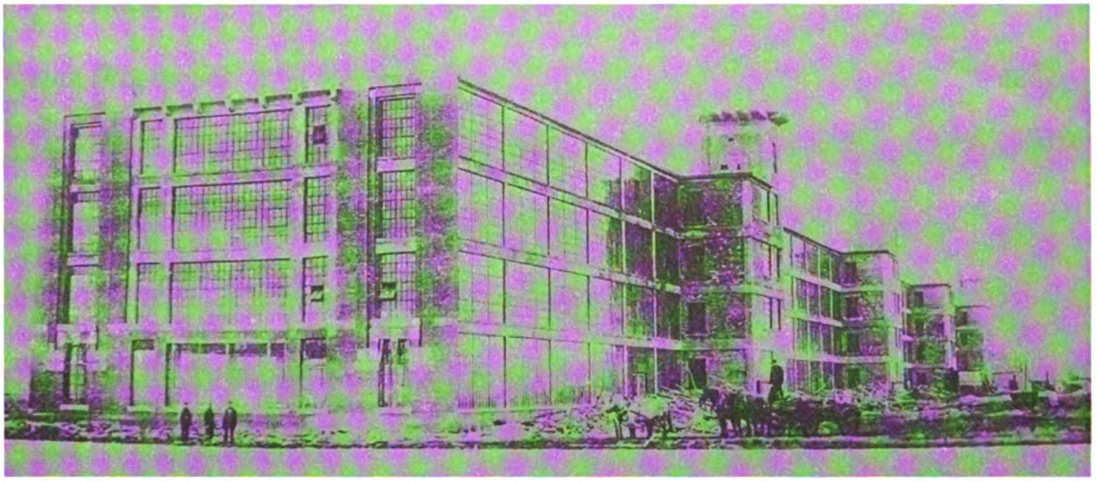

**Figure 1 Construction photo of the rear of the original factory building (Job #375) at Highland Park. Note the four communications towers, complete with penthouses.** [1]

It is hard to imagine that the factory which would produce the world's most successful automobile was built by the labor of men and horses rather than by machines. There were no tractors, no mechanical cranes, no cement mixers or power tools, only the strength of men. An industry that is now dominated by machines would rise from a time when the automobile was custom-made entirely by hand. When Henry Ford first started the construction of his Highland Park factory in 1908, Woodward Avenue was a just a two lane road that traveled out of downtown Detroit into the country. The site was a farm field, well outside of the crowded and frantic life of the city. The factory's skeleton, constructed using the new technique of reinforced concrete, was set and poured by the labor of men. Each massive load of supplies was moved by horse and wagon and hoisted to the upper levels of the structure by a system of rope pulleys. The men, working four

[1] Acc. 1660, Box 130, "Construction", The Benson Ford Research Center, The Henry Ford.

stories into the air, had no safety equipment. If they were to slip and fall, nothing stood between them and the hard Michigan ground below. In the photographs of the factory's early construction, one can still see the stalks of corn cut from the field surrounding the structure (Figure 2).[2] It is hard to imagine from these early 20th century photos that this construction site would one day become a marvel of modern American industry. This site, so humbly begun, would be the birthplace of some of the most innovative ideas of industry and architecture the world had yet seen. It was the birth of the crystal palace, the beginning of the Ford Empire, and the dawn of a new kind of industry.

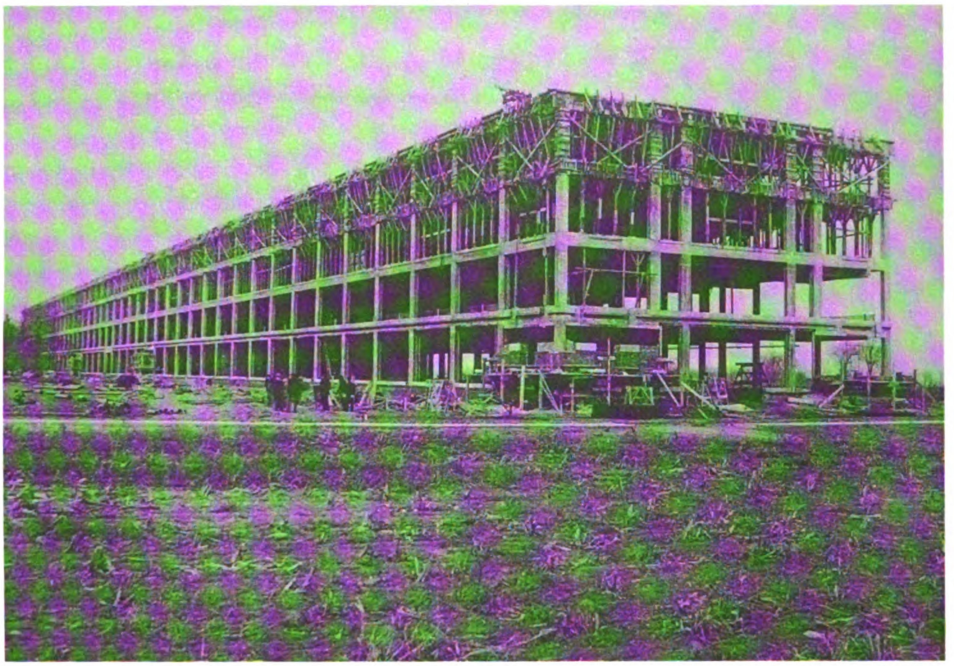

**Figure 2 Early Construction photo of the original factory building. Note the reinforced concrete construction and surrounding farm field.**

While the Highland Park factory still stands, it has been stripped of much of its former glory. A great deal of the site has been let go for so long that it is in a desperate state. Despite its current condition, the factory's history of innovation should not be ignored any longer. While many works of scholarship have touched upon Highland Park, none

[2] Acc. 1660, Box 130, "Construction", The Benson Ford Research Center, The Henry Ford.

have been devoted to assessing this site alone. This thesis has been written to bring back to life this once-mighty factory and to highlight its place among the great structures of the industrial era.

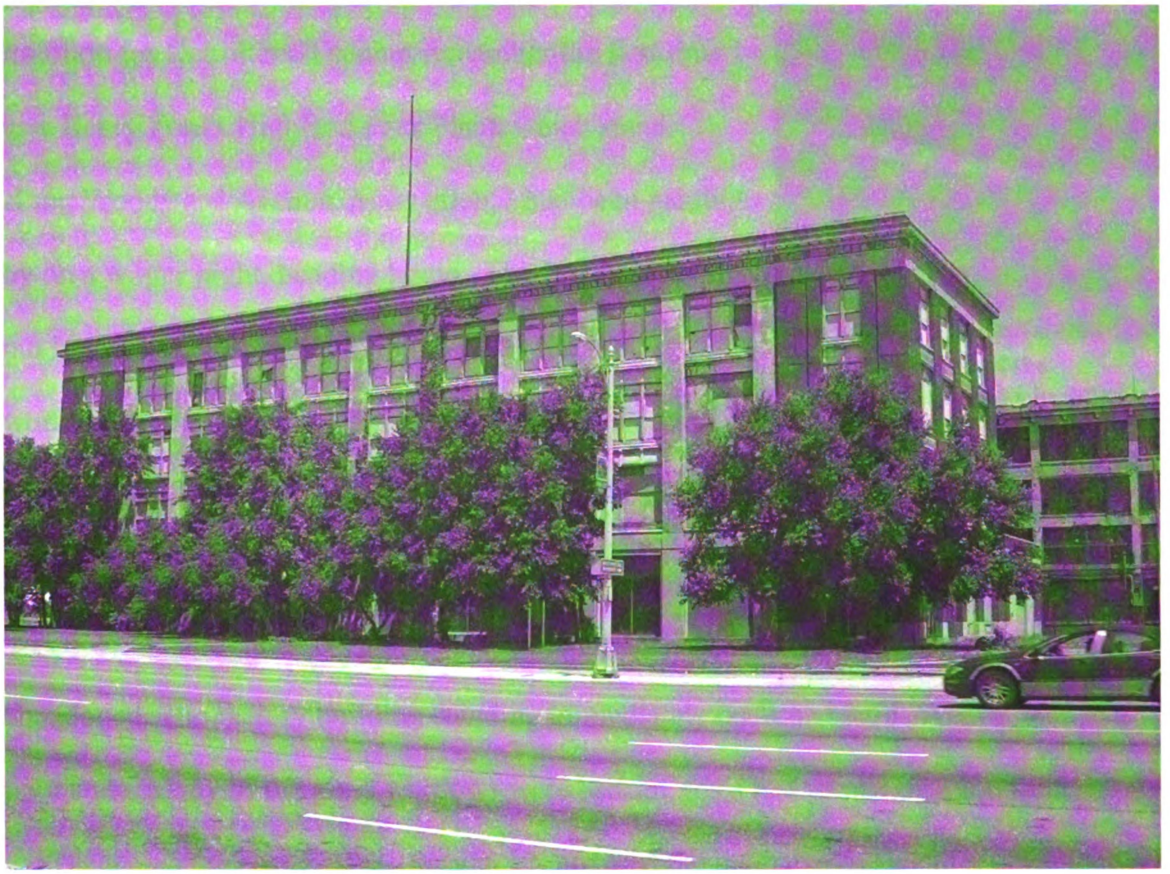

**Figure 3 Current photo of the Sales Building on Woodward Avenue.** [3]

[3] Photograph taken in June of 2008, by AKJ.

*A Cruise down Woodward Avenue*

I have been cruising down Woodward Avenue ever since I was born. Both of my parents grew up in the suburbs of Detroit, and to cruise Woodward was a tradition for Detroiters. I cannot remember the first time I saw Henry Ford's Highland Park Plant, which stands along Woodward Avenue. Most often, I had been passing by on a winter night, heading home. The building stood out in the darkness, dimly highlighted by the few working street lights that surrounded it. It was in a bad part of town, few businesses were left, and those that were had heavy metal security bars across the windows.

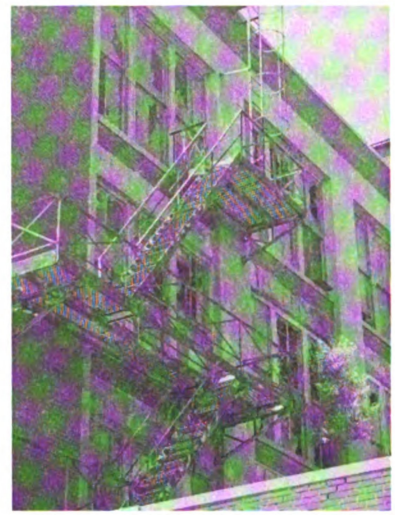

**Figure 4 Photo of the rear of the Sales building with a tree growing out of the window.**

Many of the buildings that survived around the factory itself were burned out or abandoned. The factory building standing immediately on Woodward Avenue, was in a poor state. Many of the glass windows were broken, trees had grown over the front facade, ivy covered the main entrance, and the front lawn was overgrown and peppered with trash (Figures 4 & 5)[4]. If one did not already know the building was there, they would never notice it. Not even the historical marker, buried among the trees and tall grass, drew any attention. Regardless of its less than picturesque setting, every time we passed the factory my dad would explain what it was

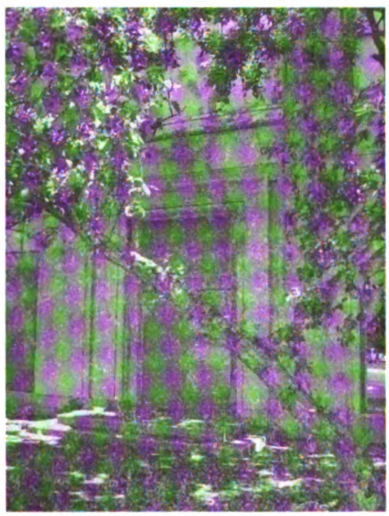

**Figure 5 Photo of the front entrance of the Sales Building.**

[4] Photograph taken in June of 2008, by AKJ.

and how it had revolutionized the world. Nearly every year we went to the Auto Show in downtown Detroit, and while driving back, I would hear about the mighty factory of Henry Ford where the Model T was built and the assembly line was first used. My dad had worked in automotive factories his entire life, including some time at Ford's River Rouge Plant. He had a passion for cars, even owning a Model T for some time. Any important sites around Detroit involving cars were admired and given their due respect by my dad. We both found it frustrating that Highland Park had been abandoned.

When I began to research this site, my first goal was to photograph its current condition. On a hot summer day, Dad and I drove to the factory. It had been several years since we had last driven by, and we were both pleasantly surprised to find the site in a better state than we had last seen it. In the last couple of years, the area around the factory has begun to recover and rebuild. New strip malls lined Woodward. The Highland Park Police department was now located directly across the street from the factory. The factory building still standing directly on Woodward (the former sales building) was still overgrown by mulberry trees, but the lawn was cut and cleared of trash. You could actually see the historic maker without having to desperately search for it. While we were there, a man with an old and smoking push lawnmower was cutting the grass on the north-west side of the building. This sight inspired hope that the community might be embracing their historic landmark. The building had not been restored, but some attempt to clean it up and repaint its wood

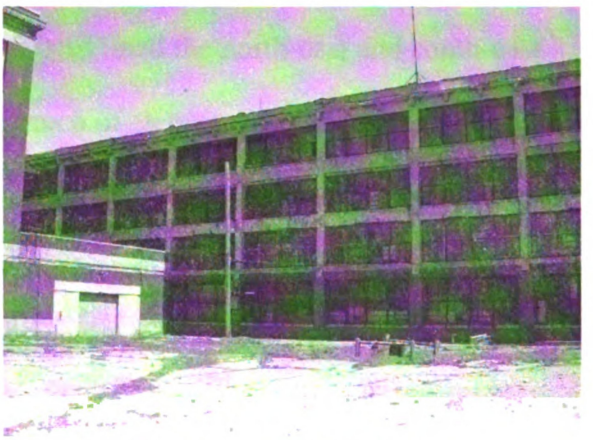

**Figure 6 Current photo of the factory extension building (Job 375 AA) situated behind the sales building.**

and brick facade had been made. My photographs began to highlight the site's former majesty. Behind the main building on Woodward was another huge structure, four stories tall (Figure 6).[5] Beyond this stood many other buildings that appeared to still be in use, including another huge factory building six stories tall, along Manchester Avenue (Figure 7).[6]

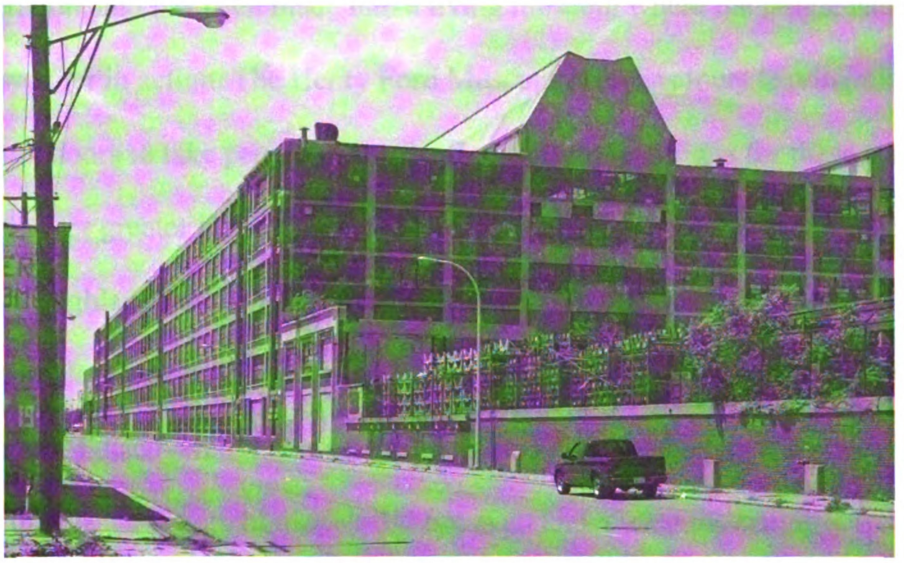

**Figure 7 Current photo of the six story extension built in 1914-1915 on Manchester Avenue.**

As we circled the factory, we began to track the perimeter of the 102 acre site. While the property along Woodward had been improving, the areas behind the factory had remained much the same. Many machine shops still lined the north-east and south-east sides. The housing to the north-west was like much of Detroit, consisting mostly of old brick houses that needed much repair. Intertwined with these however, were some new row houses that had been built recently. They were small, simple, vinyl-sided houses, which were extremely narrow and packed tightly together. Along with these, was the occasional burned out house, left to fall. While on the surface the area looked slightly

[5] Photograph taken in June of 2008, by AKJ.
[6] Ibid.

improved, it was still a rough neighborhood, judging by the substantial number of police cars patrolling the area in the several hours we were there. Overall, the factory complex itself still seemed to be quite intact and still in use, a good sign for its survival.

As I began my study of Highland Park, my first question was why this factory was not given the respect that Ford's River Rouge plant has enjoyed all these years. The Rouge is still in operation, and has been made into a living museum where the public can watch an industrial wonder in action. The Henry Ford Museum even has tours leaving directly from its front doors to take people to see the Rouge complex. Signs for these tours are plastered all over greater Detroit. But what about the Rouge's predecessor? What has happened to Highland Park? The Ford Motor Company does not even own Highland Park anymore, let alone send tours to it. It sits buried behind overgrown mulberry bushes and strip malls. I discovered that even the people waiting for the bus at the stop directly in front of the plant's historical marker did not even know what the building was, never having bothered to read the sign.

What most of the public does not realize, is that everything that can be seen at the Rouge has its roots in Highland Park. So many of the amazing developments the Rouge has become famous for, were first tried at the Highland Park complex. It functioned as the laboratory for Ford to perfect his self-sufficient production plan and manufacturing assembly-line system. It was not his first factory, but it was the first he had built himself, and as such, provides a window into the master plan Henry Ford had for the development of Ford Motor Company. It was at Highland Park that the modern automotive industry was to emerge. Due to its incredible innovation, which was openly displayed for all to

see, the entire automotive industry would turn to Highland Park as an example, and would try to develop and adopt the same methods.

My thesis thus seeks to resurrect Highland Park as an important piece of American industrial history, by examining five aspects of its past. First, it explores why Highland Park was so important in the development of both the Ford Motor Company and the automotive industry itself. This chapter provides an introduction to Highland Park's first structures and to the automotive industry of the early 1900's, setting the stage for the changes that were soon to come.

Second, the thesis focuses on how involved Henry Ford was in the development of Highland Park and its accomplishments. Had Ford not managed his factory in the way that he did, and as closely as he did, the success and innovations made at Highland Park would not have been possible. This chapter reveals the management of Highland Park and its drive for a more efficient production process, which would lead to great innovation.

The third chapter of the thesis highlights the intersection of new industrial ideas and techniques that appeared in the early twentieth century. It highlights the important accomplishments that would go on to be used not only at Henry Ford's other factories, but by other automakers and other industries as well. This chapter explores the origination and subsequent implementation of some of the most impressive innovations that would be developed at Highland Park. These innovations include the development of mass production and the assembly line, as well as some of the more radical and ground-breaking automotive projects that have been forgotten.

The forth chapter focuses on Highland Park's innovative architecture. This chapter focuses on the most important structures built at the complex as well as the new building techniques and designs used at the site. It also provides some background into the firm that built Highland Park, Albert Kahn Inc. This firm would go on to build some of the most impressive industrial structures of the time, and revolutionize the field of industrial architecture.

The final chapter looks at employee life at Highland Park. Several revolutionary services Ford provided for his employees are discussed, including his education programs, medical care, and the Ford commissary.

In all, I feel that this industrial complex is more important now than it ever has been. Very few examples of early automotive factories remain standing today. In an age when Americans are far more likely to demolish a site and build over its remains than restore and reuse it, the realization of Highland Park's important role in history may be its only salvation. With only bits and pieces of its history scattered throughout thousands of sources, the general public has no way of understanding how important the Highland Park plant was, and has no reason to want to see it saved. My goal is to piece together and preserve the site's rich and astounding history before it is lost or forgotten. It is my goal to bring this site back to life; beyond the broken windows, peeling paint and graffiti-covered walls. I wish not only to highlight its importance, but simply to allow people to better understand what is standing behind them when they are waiting for the bus.

I have organized this thesis to follow the chronological evolution of the Ford Highland Park Complex, including important innovations as they took place in the factory's timeline. Some of the factory's innovations however, overlap time periods, and are

introduced in the order of their origin. I have referred to the Highland Park factory most often as just Highland Park. This is not to be confused with the city of Highland Park, which is labeled as such. Reference to The Ford Motor Company's River Rouge Complex will most often appear simply as the Rouge, its common name used by Ford Motor Company employees.

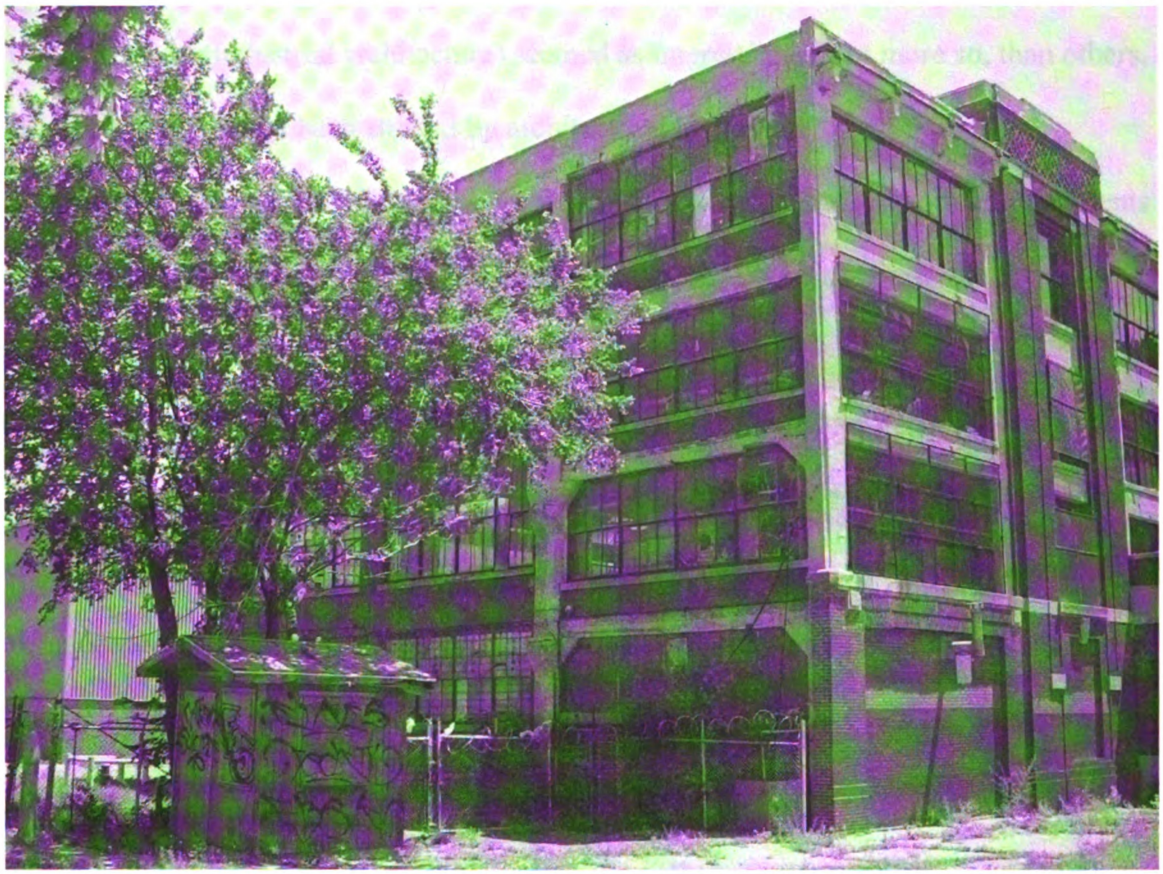

**Figure 8** **A graffiti covered guard station sitting in front of the AA extension building. Boxes of files being stored in the building are visible through the windows. Photo taken in June of 2008 by AKJ.**

# Historiographical Essay

There are several works that provide information on the state of the automotive industry during the time of Henry Ford. Betsy Hunter Bradley's *The Works: The Industrial Architecture of the United States*,[1] shows an overview of Industrial architecture, including the automotive industry. Her work however, was not intended to focus on a specific site such as Henry Ford's Highland Park plant. She states "Even though this type of architecture (industrial architecture) seemed as interesting, if not more so, than others, factories have seldom been studied by architectural historians."[2]

Many works focus specifically on the automotive industry, but only include fragments of Highland Park's history.[3] Others, focus more specifically on the Ford Motor Company.[4]

The most conclusive history on Highland Park, was Horace Lucien Arnold and Fay Leone Faurote's *Ford Methods and the Ford Shops*.[5] This work is a highly detailed view of all the operations that took place in Highland Park in 1915, a crucial point in the development of the plant. It includes many details that cannot be found in any other source. While the Ford Motor Company kept meticulous records of its operations, including those at Highland Park, many of these records have been, lost, destroyed or discarded. Much of the best existing material for this thesis has come from the Ford

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[1] Betsy Hunter Bradley, The Works: The Industrial Architecture of the United States (New York: Oxford University Press, 1999).

[2] Ibid.,VII.

[3] See, Byron Olsen and Joseph Cabadas, *The American Auto Factory* (St. Paul: MBI Publishing Company, 2002).

[4] See, for examples, Douglas Brinkley, *Wheels for the World: Henry Ford, His Company, and a Century of Progress, 1903-2003* (New York: Viking, 2003); Steven Watts, *The People's Tycoon; Henry Ford and the American Century* (New York: Alfred A. Knopf, 2005); and Ford R. Bryan, *Beyond the Model T: The Other Adventures of Henry Ford* (Detroit: Wayne State University Press, 1997).

[5] Horace Lucien Arnold and Fay Leone Faurote, *Ford Methods and the Ford Shops* (New York: Elibron Classics, 2005).

Motor Company's newspapers, kept at the Benson Ford Research Center, in Dearborn, Michigan.

Most work on Albert Kahn, Highland Park's architect, focuses either on his career in general, or specific projects.[6] Many of these works mention Highland Park, due to its significance in Albert Kahn's career as an industrial architect, but they provide little detail about the site itself. Albert Kahn Inc. even published its own book, *Industrial & Commercial Buildings*, essentially a collection of photographs of Kahn's projects, including shots of some of the structures at the Ford Highland Park factory.[7] Federico Bucci's work, *Albert Kahn: Architect of Ford*,[8] which details Kahn's work at Highland Park, fails to mention that all of the major structures built at the Highland Park complex, while owned by the Ford Motor Company, were designed by Albert Kahn Inc. The scope of Kahn's involvement and experimentation of industrial architecture at Highland Park is similarly understated.

The Highland Park complex's wide range of operations provided Kahn a perfect opportunity to develop a wide range of industrial structures, each unique to their intended use. After he had completed the first series of structures at Highland Park, Henry Ford turned over all other projects for the site to Kahn's firm. This environment of trust, along with Ford's tendency for experimentation would allow Kahn to push the limits and develop new techniques and styles of industrial building at this site. Many of these

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[6] See, for examples, Grant Hildebrand, *Designing for Industry: The Architecture of Albert Kahn* (Cambridge: The MIT Press, 1974); George Nelson, *Industrial Architecture of Albert Kahn Inc.* (New York: Architectural Book Publishing Company Inc., 1939); W. Hawkins Ferry, *The Buildings of Detroit, A History* (Detroit: Wayne State University Press, 1980); and Reyner Banham, *A Concrete Atlantis: U.S. Industrial Building and European Modern Architecture 1900-1925* (Cambridge: The MIT Press, 1986).
[7] Albert Kahn Inc., *Industrial & Commercial Buildings* (Detroit: Albert Kahn Inc., 1925).
[8] Federico Bucci, *Albert Kahn Architect of Ford* (New York: Princeton Architectural Press, 1993).

lessons would be later applied to the structures built at Henry Ford's River Rouge plant, which, contrary to Highland Park, has been thoroughly examined in work on Kahn.[9]

. The article by David L. Lewis, titled *Ford and Kahn*,[10] featured in Michigan History Magazine is useful, although the best source on the subject was Albert Kahn Inc. itself, whose company archivist was kind enough to discuss Kahn's extensive role at Highland Park.

Several works have proved crucial in the study of Henry Ford, the manager of Highland Park. One less-known work, Samuel S. Marquis's, *Henry Ford: An Interpretation*,[11] provides a unique look into the state-of-mind of Henry Ford. Several other works provide a look into relation to Highland Park, lending proof to the stories of Ford's interactions with his managers, employees and his architect Albert Kahn.[12] While an enormous amount of studies have been written on Henry Ford, and the Ford Motor Company, none focus specifically on his relationship with Highland Park, even though it was here that Ford would lay the groundwork for his future success.

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[9] Brian Carter, Editor, *Albert Kahn Inspiration for the Modern* (Ann Arbor: University of Michigan Museum of Art, 2001) provides some good information on Kahn's Highland Park work.

[10] David L. Lewis, "Ford and Kahn" Michigan History, (September/October 1980): 17-32. Albert Kahn Vertical File, Benson Ford Research Center, The Henry Ford.

[11] Samuel S. Marquis, *Henry Ford: An Interpretation* (Detroit: Wayne State University Press, 2007).

[12] See, for examples, Allan Nevins, *Ford: The Times, the Man, the Company* (New York: Charles Scribner's Sons, 1954); William Adams Simonds, *Henry Ford: His Life, His Work, His Genius* (New York: The Bobbs-Merrill Company, 1943); and George S. May, *A Most Unique Machine: The Michigan Origins of the Automobile Industry* (William B. Eerdmans Publishing Company, 1975).

# Chapter One

## Birth of the Crystal Palace:
## The Development of the Ford Motor Company

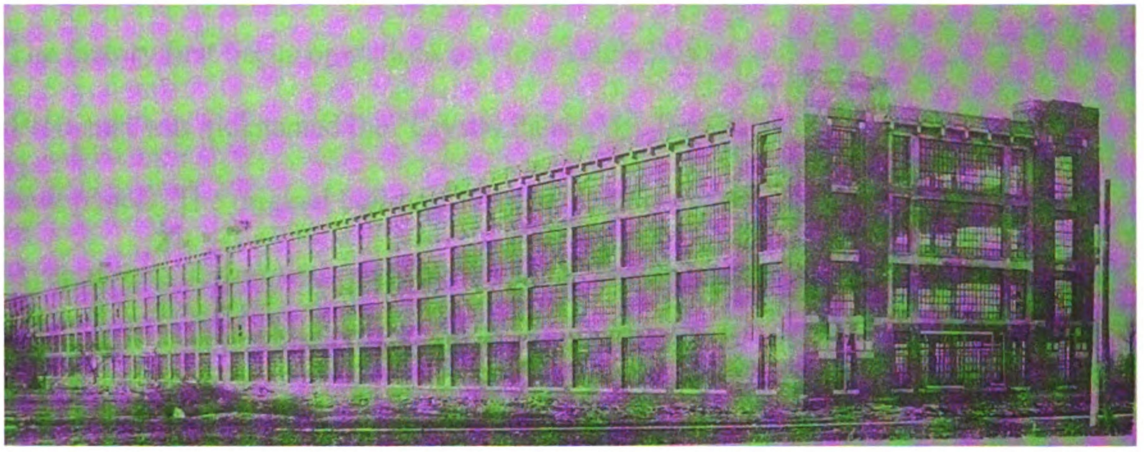

**Figure 1.1 Photo of the original factory building just after completion in 1910.** [1]

*The Original Factory at Highland Park*

The history of Highland Park begins with the Model T. To fill all of the incoming orders for Model T's in 1907 (the company was five months and 6,000 orders behind)[2], Ford needed a bigger and more advanced facility than his three story factory at Beaubien and Piquette Street in Detroit could accommodate. Highland Park would be Ford's third factory, his first having been on Mack Avenue in Detroit. The property he chose for his new factory was a horse racing track in the rural area of Highland Park, six miles outside of Detroit. He purchased it in 1907 for $62,000.00.[3]

Highland Park is situated on a nearly flat tract of land, 58 feet above the Detroit River watermark. Water supplies for manufacturing would come from three, slightly salty

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[1] Acc. 1660, Box 130, "Construction", The Benson Ford Research Center, The Henry Ford.
[2] Patricia Montemurri, "Ford to sell historic Highland Park site" Detroit Free Press, (August 21, 1981). Highland Park Vertical File, 1 of 2, Benson Ford Research Center, The Henry Ford.
[3] Horace Lucien Arnold and Fay Leone Faurote, *Ford Methods and the Ford Shops* (New York: The Engineering Magazine Company, 1919), 23.

artesian wells, and drinking water would be provided from Detroit's city mains. The ground, composed of three feet of sandy loam overlying a deep-blue clay-bed with a base of limestone, provided a perfect base for large structures. The construction of the first building was begun in 1908. The factory first began operations on New Year's Day of 1910, and was nicknamed the "Crystal Palace" by Detroit newspapers. The original building, situated on Woodward Avenue, was 75 feet wide and 860 feet long. The building was made using reinforced concrete and followed the similar plans of the Packard Building #10 and the Mergenthaler Linotype Company building.[4] Along the length of the exterior walls, spaced at a length of twenty feet each, were a series of metal framed windows imported from England that spanned nearly the entire height of the building. In its entirety, the building would use 50,000 square feet of glass.[5]

**Figure 1.2 Current photo of the tower on the 375 AA extension building.**

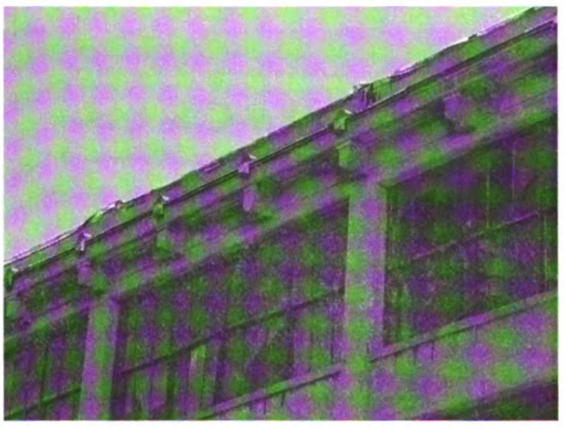

**Figure 1.3 Current photo of the cornice of the AA extension building.**

These windows provided light and ventilation, as well as visibility to the public of the factory's operations. Attached to the outer wall on the rear of the building were a series of externally attached communications towers, covered in brick.

[4] Bucci, *Albert Kahn*, 41.
[5] Montemurri, "Ford to sell,".

Albert Kahn, the factory's architect, also incorporated several artistic elements.[6] Along the top roofline was a beautiful decorative cornice of cement, with small, brass or copper medallions equally spaced and connected by a thin straight line along its length. Below this were u-shaped post-like protrusions (Figure 1.3).[7] The top three stories had bare cement beneath the windows, but the bottom floor had brick beneath the windows. The communications towers, as well as the corners of the building, were covered in brick with a beautiful diamond-shaped herringbone design. At the very top were limestone highlights, including a keystone above the door at the base of the tower (Figure 1.2).[8] With all the glass, brick, and cement, as well as limestone highlights, the building became more than a factory, and was quite suited to its nickname of the "Crystal Palace". Albert Kahn combined practicality with a simple beauty, befitting Henry Ford's seeming preference for that which was straight-forward yet elegant.

The best evidence of the original factory is its blueprints. They were made of linen, with the architectural drawings printed on the fabric, and can be seen at the Bentley Historical Library at the University of Michigan, Ann Arbor. This blueprint technique

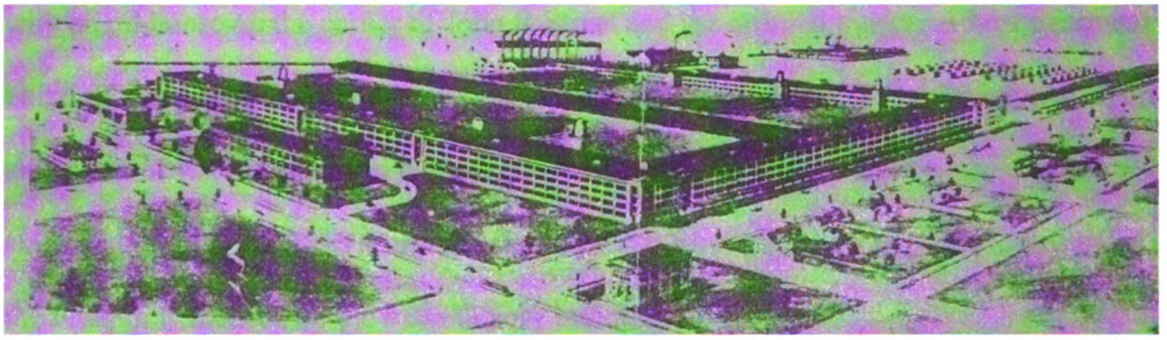

**Figure 1.4 Arial photo of the Highland Park complex taken in July of 1911. Note the original power house to the far left and the original two story administration building.**

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[6] For more on Albert Kahn's factory aesthetics and their continued admiration today see Nina Rapport, "Albert Kahn and the Modern Factory" *Metropolis*, (June 1996): 25-31.

[7] Photograph taken in June of 2008, by AKJ. This cornice is identical to the the original factory building.

[8] Photograph taken in June of 2008, by AKJ. This building was nearly identical in design to the original factory building with the exception of the external communications towers and a shorter length.

made the prints virtually indestructible and able to be washed: excellent characteristics for a blueprint that would be on a construction site, exposed to all sorts of perils. The blueprints provide evidence of Kahn's genius for simplicity. The first factory building plan was titled Job 375,[9] and shows several buildings on the complex (Figure 1.4).[10] Ford's land sat directly along Woodward Avenue, between the railroad tracks to the north-west, Manchester Avenue to the south-east, and Oakland Avenue to the north-east. Two streets, parallel to Woodward ran through the property, dividing it into thirds: John R Street, closest to Woodward, and Brush Street behind it. The majority of the first buildings were to be situated on Woodward Avenue. The original factory, the largest and first to be erected, is no longer standing today. An extension to the original factory, labeled Job #375AA, appears to be a near exact match of the original, and still stands behind the sales building. This extension provides a visible example of the original's style.[11] Directly in front of the original factory was an office building. To the left of the office was a power building, and to the right was a garage, both lying directly along Woodward Avenue's sidewalks. A machine shop was erected behind the main factory, with an oil house on the corner of John R Street and the railroad tracks. A heat treatment building was situated directly across the street from the oil house. The foundry, placed on the corner of Brush Street and the railroad tracks, was the farthest back of the original structures. While Job 375's sheet X-1 showed the overall plan of the complex, the rest of the blueprints focused on the main factory building.

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[9] Job #375 1908-1909 Drawer 1 Folder 1. the Bentley Historical Library, University of Michigan.

[10] Vertical file, Ford Motor Company, Plants, Highland Park, The Benson Ford Research Center, The Henry Ford.

[11] The extension is of a much smaller length of the original factory. It is also lacking the communication towers that were on the original factory. The exterior is done in the same style as the original, and the floor plan appears to be nearly the same as well.

The factory building itself had four floors, each nearly identical. The foundation was made up of two rows of columns, which ran the length of the building and were identically spaced with the columns along the outside wall. All together, each floor was supported by 336 columns, spaced twenty feet apart. The main floor began with an elevator on the south end. The floor was divided into quarters by three brick dividing walls with concrete supports. Along the rear of the structure were a series of four towers, 32' 11" long and 15' 9" wide (each varying by no more than an inch), with identical floor plans on each level of the factory. On the left side of the tower was a hydraulic freight elevator, next to which was a toilet with four stalls and two urinals. The toilet also served as a changing room for the workers. Just outside of the toilet, directly on the factory floor, was a massive sink. To the right of the toilet room was a staircase. The very top of the towers protruded higher than the factory roof and were labeled as penthouses.

A large tank sat behind the factory. It is noted as not being part of this contract on the blueprint, and as such, the details were excluded. On the south-east corner of the factory were mounted massive eight foot tall Ford Motor Company letters of galvanized iron with galvanized wire mesh behind. These letters were pictured in many photographs and became an icon of the Ford Motor Company (Figure 1.5).

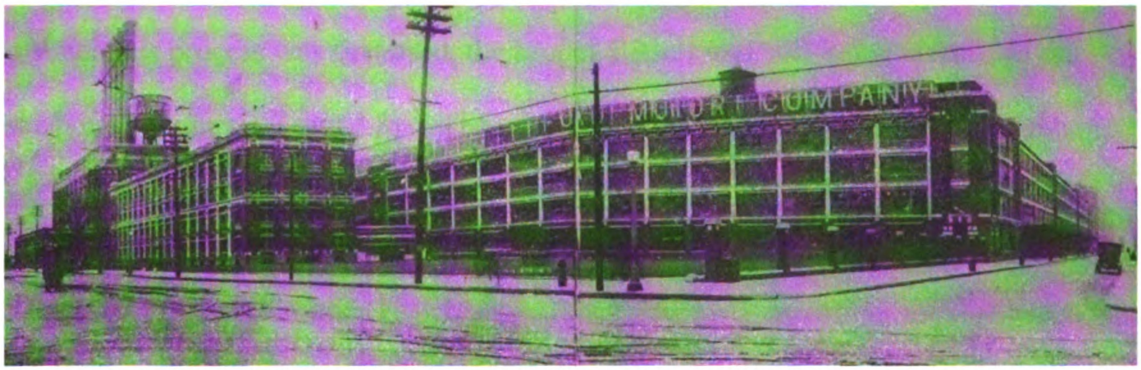

**Figure 1.5 Photo of the corner of Woodward and Manchester. Note the legendary Ford Motor Company letters. The new power plant and administration building can also be seen to the left. Courtesy of Albert Kahn Inc.**

By 1912 the factory employed 4,500 worker and would consist of an administration building, power building, foundry, heat-treating plant, forge, machine tool room, machine shop, radiator department, painting and varnishing department, assembling department, testing room, experimental laboratory (Figure 1.6),[12] and shipping department.[13]

By 1913, Highland Park was producing enough material to ship parts to Ford's factories in Buffalo, Portland, Dallas and other cities across the country for final assembly.[14] It was during this time that experimentation with the assembly line began. Its first incarnation was the assembly of the Model T's flywheel magneto. The casing was placed on a conveyor belt, and as it passed, a series of workers along the line added the necessary parts. Henry Ford was quoted as saying of his assembly line, "The man who places a part does not fasten it. The man who puts in a bolt does not put on the nut. The man who puts on the nut does not tighten it."[15]

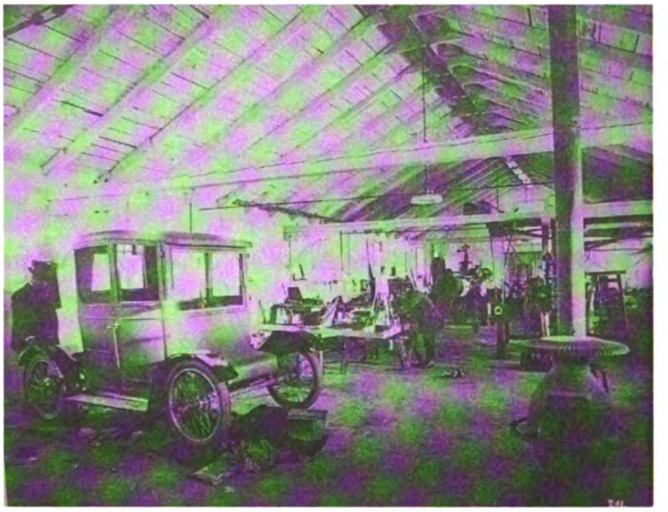

**Figure 1.6 Photo of Ford's experimental laboratory taken in 1912. The car in the photo is an electric-powered Model T. Clara, Ford's wife was said to drive an electric car such as this, preferring it to the gas-powered model.**

When this process was first used, the Model T itself was still being assembled on sawhorses (Figure 1.7 and 1.8).[16] The assembly line for the Model T chassis began, according to the company's historians, with a large Danish worker dragging a chassis

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[12] Acc. 1660, Box 131, interiors, The Benson Ford Research Center, The Henry Ford.
[13] Ford Facts, 1912-1959, Vertical Files, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.
[14] Ibid.
[15] Ron French, "New industrial society rolled off Model T line" *The Detroit News and Free Press*, (March 7, 1999), Vertical File, Highland park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.
[16] Figure 6 and 7, Vertical file, Albert Kahn, The Benson Ford Research Center, The Henry Ford.

behind him, while other workers added parts. [17] Although not quite the image most people would expect, this single act was to start a revolution in all areas of industry. The effects of the assembly line, for better or worse, would come to change the world and begin a new age.

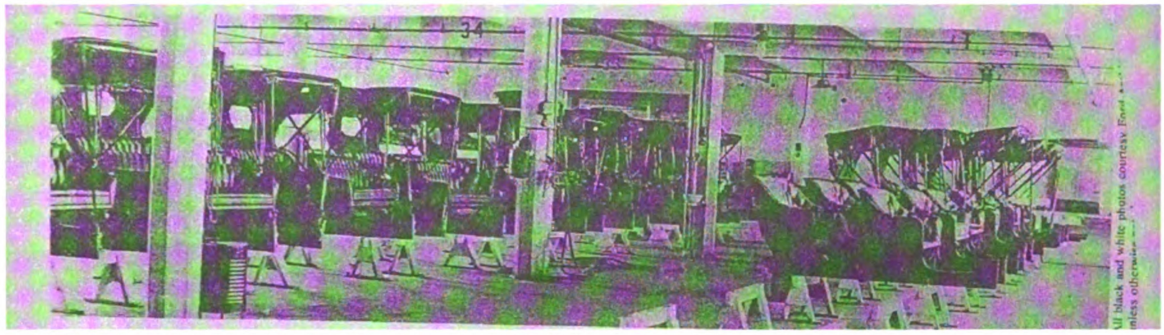

**Figure 1.7 Model T's being assembled on saw horses prior to the development of the assembly line.**

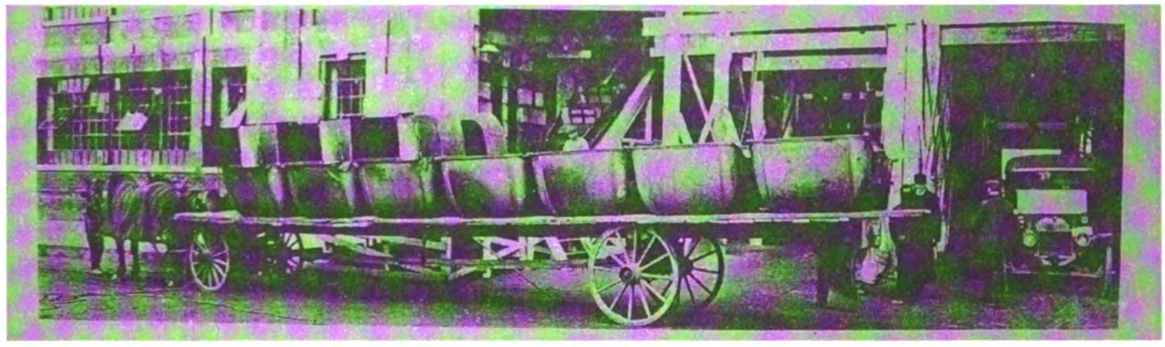

**Figure 1.8 A wagon pulled by horses delivers Model T chassis' to the early assembly line.**

[17] Iver Peterson, "Ford selling factory rich with history" New York Times, (August 21, 1981), Vertical File, Highland park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.

# Chapter Two
## The Visionary:
## Henry Ford's Role in the Development of Highland Park

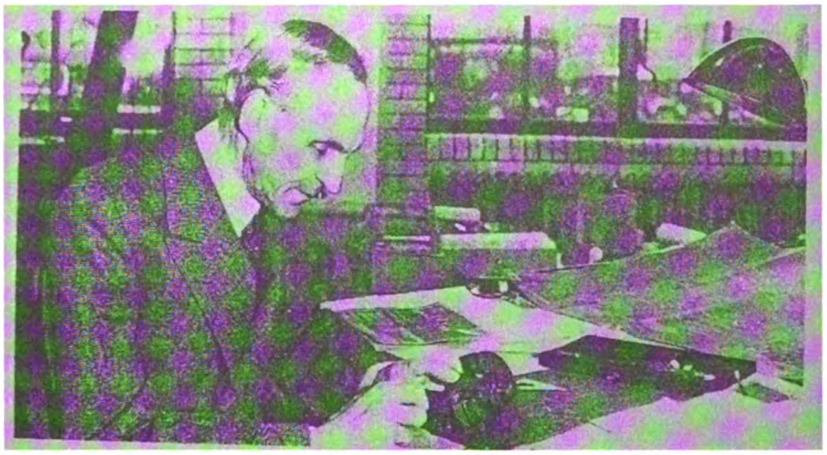

**Figure 2.1 Henry Ford sitting in the Engineering building at the River Rouge Plant in 1934.**[1]

*Highland Park, a Laboratory for Industrial Production*

One truly progressive aspect of Highland Park was its accessibility. Ford made no effort to hide what was being done at Highland Park, instead allowing the public full access to see its operations. Guided tours were given to anyone interested, which was no small amount. People came from all over to see the factory, including Ford's competitors, engineering societies, and other industrial businesses, along with press reporters. A book was even written about its operations titled *Ford Methods and the Ford Shops* by Horace Lucien Arnold and Fay Leone Faurote. This book provided intimate details of the inner workings of the factory (Figure 2.2).[2] According to the authors,

[1] Vertical File, Albert Kahn, The Benson Ford Research Center, The Henry Ford.
[2] Acc. 1660, Box 131, "Industry, Highland Park", The Benson Ford Research Center, The Henry Ford.

most notably of all, the Ford company is willing to have any part of its commercial, managerial or mechanical practice given full and unrestricted publicity in print. Therefore these disclosures of Ford company means and methods will be read with deep interest by all students of metal-working economies the world over. [3]

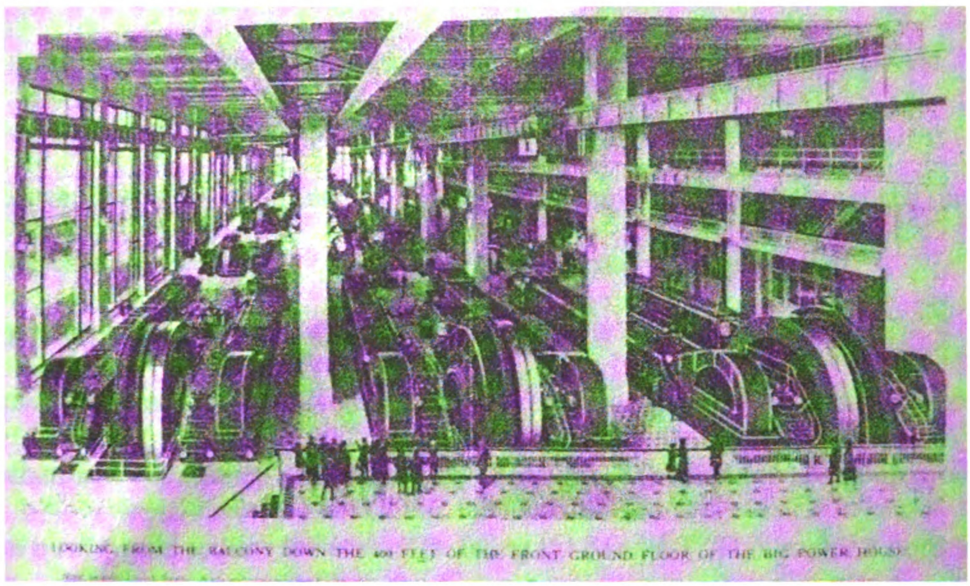

**Figure 2.2 Illustration of visitors overlooking the massive four hundred foot ground floor engine room in Highland Park's redesigned power house.**

At a time when business, especially the automotive industry, kept its secrets under lock and key, Ford's openness was revolutionary. Operating in this way brought great publicity to the company, but it also ushered in a new mode of conducting business through public relations. According to author Douglas Brinkley, "While the River Rouge plant would be even more enormous, neither it nor any other manufacturing facility since would drive the entire industrialized world forward the way Ford Motor's Highland Park plant did between 1910 and 1925." [4] Highland Park began a new era in the production of automobiles. Methods and equipment never before seen and hardly dreamed of would be

[3] Arnold and Faurote, *Ford Methods*, 8.
[4] Brinkley, *Wheels for the World,* 139.

employed at Highland Park. When Frederick J. Haynes, chairman of the board of Dodge Brothers, toured the factory after the 1915 expansion, he concluded that Highland Park had the best production setup of any factory in the nation.[5]

The factory also ushered in a new concept of business that has been labeled "Fordism". It is defined by historian Douglas Brinkley as,

> the restless approach to management that would sweep the industrialized world during the next fifteen years and that remained the business norm ever since...The basic idea was that the product itself may or may not be improved (in the case of the Model T, it was barely changed during nineteen years of production), but the system behind it must be made better, continuously.[6]

Between 1908 and 1914 Ford specialized machinery, organized the assembly process, and mechanized operations.[7] All these innovations were intended to speed up production, which in turn, would reduce the cost of building the Model T. This enabled Ford to lower the retail price and sell more cars. Even the move of raising his workers wages to five dollars a day, which undeniably helped improve the living standards of his workers, had the added bonus of allowing them the income to buy a car. Ford, in a sense, created his own market. It is hard to imagine that one single site could inspire so much change, but in the case of Highland Park it is true. What Ford accomplished here would be repeated the world over in many different areas of industry, beyond the production of automobiles. While not all of Fordism's effects can be considered entirely beneficial to mankind, there is no denying that it started on Woodward Avenue. Exactly what role Henry Ford had in

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[5] Ibid.
[6] Ibid., 141.
[7] Clarence Hooker, *Life in the Shadow of the Crystal Palace, 1910-1927: Ford Workers in the Model T Era* (Bowling Green: Bowling Green State University Popular Press, 1997): 29.

the development of these new innovations developed at Highland Park is the next question to answer.

*Ford's Management*

While Henry Ford built his first car himself, he did not necessarily do the same with Highland Park. Ford had a gift for finding the right people for the job. He set out looking for certain qualities and settled for nothing less. His men, experts in their fields, fulfilled his wishes by whatever means necessary. It is likely, with the complexity of his business, that Henry Ford did not see to every detail of the evolution of Highland Park. He left the job in the hands of his men, which they accomplished with great success at the factory. Regardless of Ford's reliance on very capable managers, he certainly was intimately aware of what his company was up to as a whole, keeping a close eye on his managers and their actions. Ford was the ideal manager, he let his men work, but made sure this work fit into his vision. Arnold and Faurote report that Ford himself and his immediate assistants focused on three main objectives:

> From the very first showing of the second car, 1902 up to the present day, Mr. Ford's energies and those of his immediate assistants have been directed wholly to three principal objects: first to the production of enough cars to meet purchaser's demands; second, to making car improvements; and third, to means for distributing cars and instructing and assisting Ford car buyers and users in the proper care and management of their new vehicles. The general scheme of the Ford Motor Company's operations has been largely of Mr. Ford's origination, but details of organization have been carried out by others. So far as a close observer

> can discover, Ford himself has no premeditations, but acts wholly upon inspiration.[8]

It was thus left to his men to make Highland Park into the booming success it would become.

Henry Ford's ability to pick the right person for the job led to his choosing Harold Wills, the man who helped create the Model T, as head of operations at Highland Park. In the beginning, Wills' focus was on improving the Model T. Peter E. Martin was the production supervisor, and focused on the machine shop, while his assistant Charles Sorenson, focused on the pattern-making department. Regardless of being an assistant, it was said that Martin and Sorensen operated as equals.[9] The two men are an example of the different states so commonly found in the Ford Motor Company. Martin, while tough, was said to be fair and reasonable with his employees, while Sorenson was said to be loud and mean tempered, causing those around to fear him and even hide from his presence.

Another important player was Carl Emde, head of the tool-design section. Most of the factory's updated machinery would come from under his guidance. Ford took notice of rising stars on all ranks. The company rewarded its good workers, who were promoted generously.[10] Employees with a good mind for improvement could rise through the ranks to become managers themselves. One such man was William C. Klann, who was responsible for Highland Park's first assembly line. Men such as these would come to lead the innovative projects the Highland Park was to develop.

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[8] Arnold and Faurote, *Ford Methods,* 19-20.
[9] Brinkley, *Wheels for the World,* 150.
[10] Ibid., 151.

*The Five Dollar Day*

A major change was to occur in 1914 that would have a profound effect on the story of the Highland Park Plant. On January 5, Henry Ford announced his plan to pay his workers five dollars a day, for an eight-hour work day. This was over double his workers current salary of $2.34.[11] One can only understand the magnitude of this change by thinking about our own current salaries doubling. It was a decision that would rock the nation. By shortening worker's day to eight hours, the factory could employ three shifts of workers. The very next day after the announcement was made, 10,000 men lined up outside the factory looking for work. Those who didn't receive jobs the first day came back the next. On the third day, Ford security officers turned fire hoses on the crowd to get them to leave after they refused to go on their own. This is one of the many examples of Ford's dual personalities. While very eager to help his fellow man, Henry was also the strict father figure, expecting his workers to follow orders without hesitation and had a sheer intolerance of anything less. While Ford paid his men well, working conditions in early 1900's automotive factories were not exactly pleasant. While the factory boasted of central heating for Michigan's brutal winter months, the heat of the summer months combined with heavy working machines was enough to leave most in a heap on the floor.[12] There is no doubt that the weight of the impressive advances at Highland Park was borne on the backs of its workers. While Ford did much to improve their situation as far as their standard of living outside the factory walls, the story inside was a bit different. With the birth of the assembly line, most workers were no longer thinking individuals who accomplished a given task; they had simply become cogs in a machine. The

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[11] Amy Wilson, "Giant of Industry" *Detroit Free Press*, (October 18, 1995), Vertical File, Highland Park, Folder 2 of 2, The Benson Ford Research Center, The Henry Ford.
[12] Ibid.

conditions of the factory itself were not as ideal as they appeared from a distance. The work was demanding. The speed of operations was set at a high rate with little to no tolerance for those who stepped out of place or fell behind. Because no inch of space was left unused in the factory, the packed conditions of the factory floor, notably the overhead belting that ran the factory's machines, allowed little of the precious light from the factory's massive windows in.

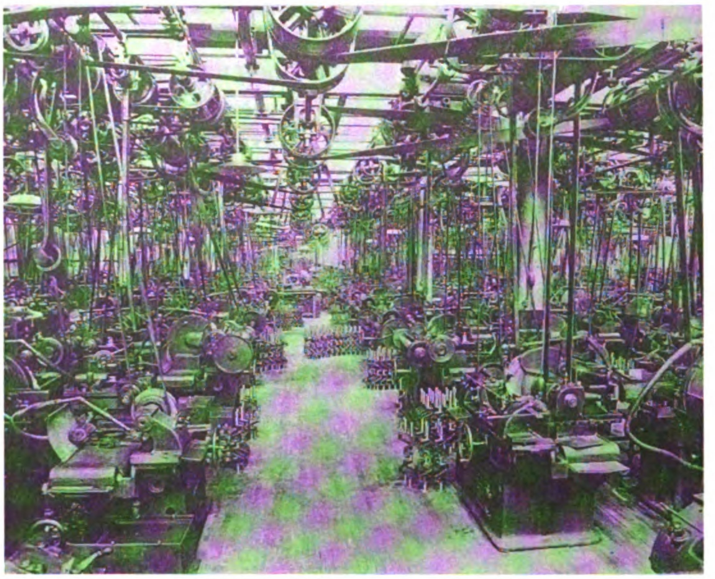

**Figure 2.3 Photo of Highland Park's crank shaft machining area. These machines were powered by an overhead drive belt system.**

The machines themselves were also dangerous with open moving belts and parts, which could easily suck a worker's hands or clothing into the machine (Figure 2.3).[13]

Ford's administrators ran their workers as efficiently as their machines. Workers were forbidden to whistle, sing, or talk while on duty. They could not sit down, or even lean while working either. Supervisors kept a constant eye on the workers (Figure 2.4).[14] Their only break was 15 minutes for lunch. Turnover of workers was quite high, mostly attributed to the dirty, monotonous, physically demanding, and fast pace of assembly line work.[15] In his book *Abroad at Home*, author Julian Street wrote of the conditions in the factory after touring it in 1914.

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[13] Acc. 1660, Box 131, "Machine Shop, 2296", The Benson Ford Research Center, The Henry Ford.
[14] Acc. 1660, Box 131, "Machine Shop, 833-163", The Benson Ford Research Center, The Henry Ford.
[15] Ibid.

Of course there was order in that place, of course there was a system-restless system-terrible 'efficiency', but to my mind, unaccustomed to such things, the whole room, with its interminable aisles, its whirling shafts and wheels, its forest of roof-supporting posts and flapping, flying, leather belting, its endless rows of writhing machinery, its shrieking, hammering and clatter, its smell of oil, its autumn haze of smoke, its savage-looking foreign population-to my mind it expressed butone thing and that was delirium...

Fancy a jungle of wheels and belts and weird iron forms-of men, machinery and movement-add to it every kind of sound you can imagine: the sound of a million squirrels chirking, a million monkeys quarreling, a million lions roaring, a million pigs dying, a million elephants smashing through a forest of sheet iron, a million boys whistling on their fingers, a million others coughing with whooping cough, a million sinners groaning as they are dragged to hell-imagine all of this happening at the very edge of Niagara Falls, with the everlasting roar of the cataract as a perpetual background, and you may acquire a vague conception of that place. [16]

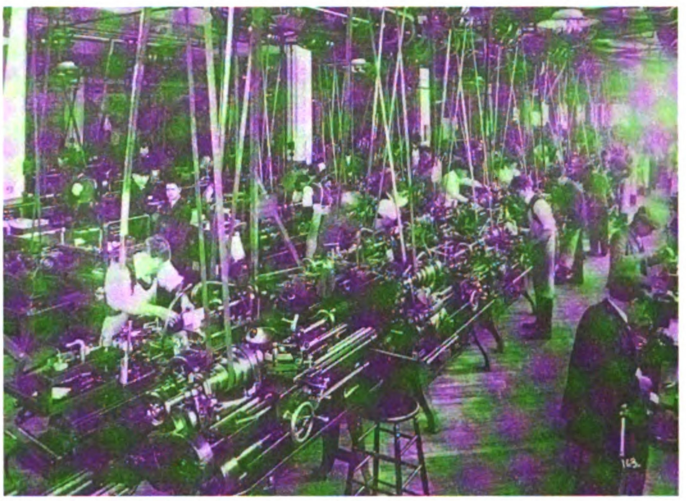

**Figure 2.4 Photo taken in 1913 of machinist working on metal lathes. Note the supervisor monitoring the workers, visible just above the worker in white on the left.**

[16] Douglas Brinkley, *Wheels for the World* (New York: Penguin Group, 2003): 155.

Regardless of these demanding conditions, most workers were grateful to have a steady, well-paid job (Figure 2.5).[17] With Ford's substantial pay raise, these Michigan workers were positioned to become a more affluent middle-class society.

Workers came from near, far, and very far to seek a job at Highland Park. According to Bob Casey, Curator of Transportation at The Henry Ford Museum, the effect was,

> a tremendous expansion of the middle class, an acceleration of the move from rural America to urban America and an accelerated immigration from across the ocean.[18]

People flocked to Highland Park. Between 1910 and 1920, the city's population went from 4,000 people to 40,000. It reached its peak in 1930 at 52,000. Currently, the population of the city stands around 20,000, very few of which work at the factory anymore. Worker housing also began to expand (Figure 2.6).[19] Ninety percent of the city of Highland Park's current homes were built between 1914 and 1920.[20]

**Figure 2.5 Photo of women workers in circa 1910, sorting and assembling parts.**

Another effect of Ford's pay raise announcement was a stockholder's rebellion. They were convinced the company would never survive such a hike in cost. To make sure it happened, Ford began buying all the company's stock. The Ford Motor Company came entirely under Henry Ford's control and would remain in the hands of his heirs until 1956

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[17] Vertical Files, Albert Kahn, The Benson Ford Research Center, The Henry Ford.
[18] Ron French, "New industrial society rolled off Model T line" *The Detroit News and Free Press*, (March 7, 1999), Vertical File, Highland park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.
[19] Figure 6- Acc. 721, Box 22 "Highland Park Construction, 4862", The Benson Ford Research Center, The Henry Ford.
[20] Ibid.

when Henry Ford II reinstated public sales of stock.[21] This control would allow Ford to expand his company on a level never before seen in the automotive industry, which in turn would lead to the building and expansion of his factories.

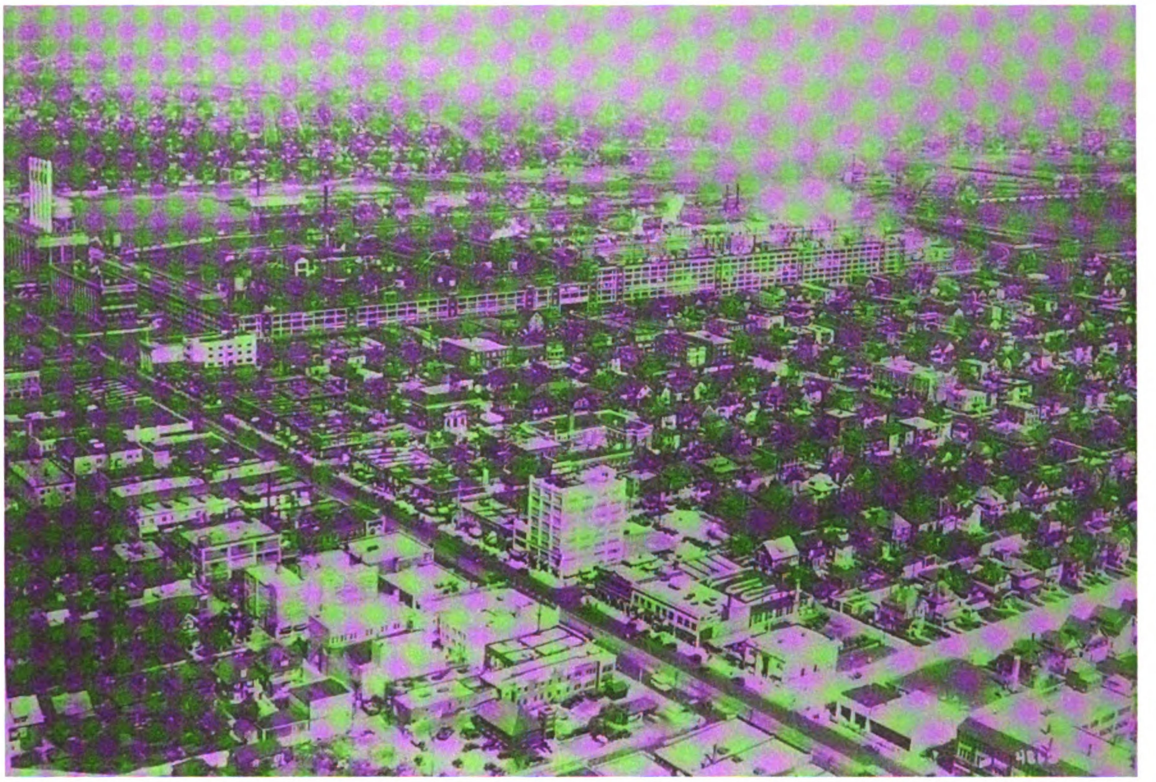

**Figure 2.6 Arial photo of the Highland Park complex taken in 1927. Note the large number of businesses and housing that had been built around the complex.**

[21] Peterson, "Ford selling factory,".

# Chapter Three
## Breaking Legs and Building Model T's:
## New Industrial Ideas and Techniques Used at Highland Park

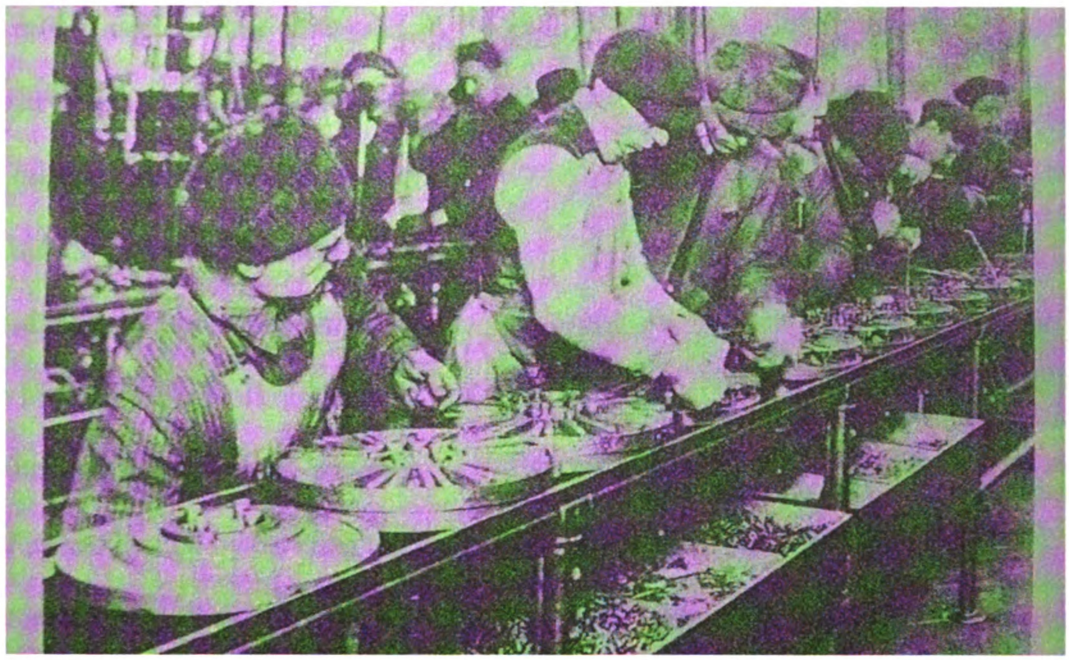

**Figure 3.1 Photo of the first magneto assembly line at Highland Park in 1913.**[1]

*The Evolution of Mass Production*

Most of the concepts that were to make Highland Park famous did not originate with Henry Ford. Ford would instead gather existing ideas into a coherent system that he then applied to the automotive industry in his innovative factory. A pamphlet titled *The Evolution of Mass Production* distributed by the Ford Educational Affairs Department explained the history of Ford's production line.[2] The article credits the idea of interchangeable parts to Eli Whitney in 1798, when he used such parts to produce 10,000 muskets for the U.S. government. Oliver Evans first used power conveyors in an

[1] Vertical File, Highland Park, "Evolution of Mass Production" The Benson Ford Research Center, The Henry Ford.

[2] "The Evolution of Mass Production" *Ford Educational Affairs Department*, Vertical File, Highland Park Assembly Lines, Benson Ford Research Center, The Henry Ford.

automatic grain mill he designed in 1783, reducing the amount of workers needed to only two. One worker would load the hopper full of grain and the other would stack up the finished sacks of flour (Figure 3.2).[3] The article also cites the meat-packing industry's use of a type of assembly-line method in dressing carcasses in the 1860's. The idea of dividing work is said to have come from Elihu Root, who in 1849 while working for Samuel Colt producing six-shooters, sped up production by dividing the steps of manufacturing and simplifying the jobs performed, as well as inventing new machines to fill gaps in the sequence of production. Lastly, Frederick Winslow Taylor studied the speed at which workers could perform a task and theorized how to make their job more efficient by eliminating unnecessary movement. Ford's success, the article claimed, was to take all these ideas and apply them to the production of automobiles. According to the article, he heavily used interchangeable parts which reduced the need for skilled labor, which was scarce. He constantly experimented with slides and conveyors as well as the stationing of men and materials to improve efficiency. Then of course, there was the final assembly line for his Model T. The factory interior housed an open floor plan, with few dividing walls. The open space was perfect for the constant changes and experimentation that the company

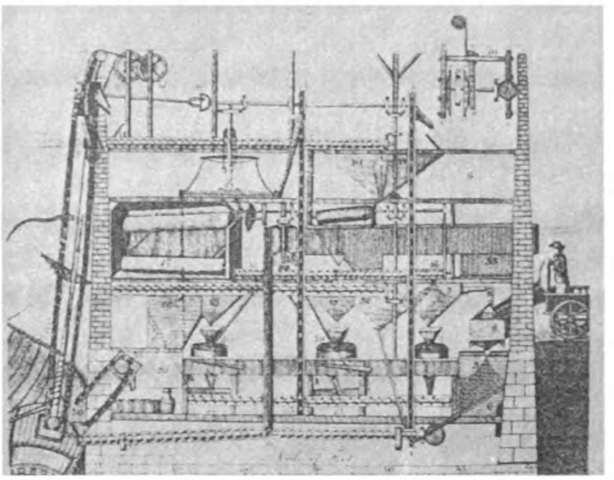

**Figure 3.2 Illustration of the automatic grain mill designed and built by Oliver Evans in 1783.**

[3] Vertical Flies, Highland Park, "Evolution of Mass Production", The Benson Ford Research Center, The Henry Ford.

instituted in its production, and provided the ideal setting for the development of the first assembly lines.[4]

Within the original factory at Highland Park, the construction of the Model T worked from top to bottom in a very complex system of separate but interdependent operations. Raw materials were hoisted to the roof by hydraulic lifts, worked their way along a system of conveyors, and down through the thousands of various holes in the floors.[5] On the fourth floor, fenders, hoods, upholstery and radiators were made. The third floor saw to the production of wheels, tires, lamps, floorboards, and tool boxes, as well as the painting of the Model T's body. On the second floor the body was assembled. On the ground floor the chassis was machined and assembled.[6]

*The Assembly Line*

A very important player in the early development at Highland Park came not from the ranks of Ford's officials but from a foreman named William C. Klann. Historian Douglas Brinkley describes Klann's role in his book *Wheels for the World.* According to Brinkley, in 1912 Klann visited Chicago. In a 1955 interview he explained the importance of this trip. "I went down to Chicago to the slaughterhouse myself. I came back and said, 'If they can kill pigs and cows that way, we can build cars that way and build motors that way."[7]

Klann told P.E. Martin of his idea of using conveyors such as the ones in Chicago. While Martin remained skeptical, he allowed Klann to give it a try. Klann, was not the

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[4] Bucci, *Albert Kahn*, 42.
[5] Ibid., 42.
[6] Brian Carter, ed., *Albert Kahn Inspiration for the Modern* (Ann Arbor: University of Michigan Museum of Art, 2001): 32-35.
[7] William C. Klann, "Reminiscences" (Oral History Project): 22-23, The Benson Ford Research Center, The Henry Ford.

only man to claim Ford's first assembly line. Bill Knudsen and Ernest Pederson, have also claimed to be the first, and may have done so on some level. It was Klann however, that first started the assembly of magneto coils, Ford's first true assembly line. Klann broke down the assembly of the coils and put together a sequence for workers to follow. The firs experimental line worked well and Klann set about designing an assembly line for the entire flywheel magneto. This line was to become the first moving assembly line at Highland Park, reducing the time to make a flywheel magneto from twenty minutes to thirteen minutes and ten seconds. Klann then moved on to crank cases, but this line was not to go as smoothly as its predecessor. The piece weighed one hundred and twenty pounds and if not properly clamped down, it would fall off the line. This resulted in a broken leg on the second day of operation. According to Brinkley, this incident nearly ended the assembly line at Highland Park. When James Couzens arrived to discuss the incident with Klann, he ordered the line shut down. Klann reported that Couzens said, "If you are going to just break legs, let's shut the thing off".[8] Klann tried to argue the merits of his line, but Couzens was unwilling to compromise worker safety and kept his stand. This line of thought, while nearly

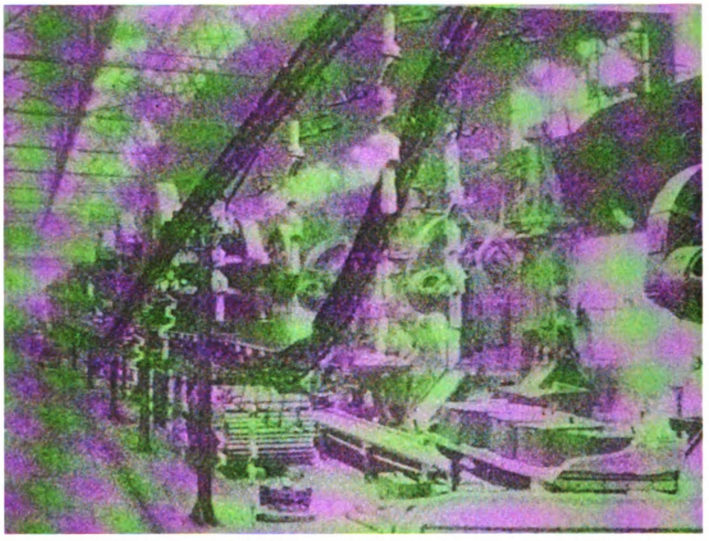

**Figure 3.3 Photo of hot crank-shaft forgings traveling down the conveyor to the trimming process.** [9]

[8] Ibid., 29-30.
[9] Vertical File, Highland Park, "Industry Illustrated", The Benson Ford Research Center, The Henry Ford.

causing the demise of the concept, did lead Ford Motor Company to have the best safety record in the country as recognized by the National Safety Council.[10] Klann refused to give up the idea however, and continued anyway with the help of P.E. Martin and Charles Sorensen. The problem was solved within a month by using better clamps, and a worker at the front of the line to clamp the crank case to the conveyor before it went down the line. This experiment demonstrated that even heavy parts could be constructed using an assembly line, leaving the technique open to all parts of the car, including the final assembly of the chassis. The first chassis assembly line did not actually take place within the original factory building but rather behind it. A scaffold-like structure was set up along the back wall of the factory and Model T bodies slid down a large ramp unto the chassis and drive train (Figure 3.4).[11] It did not take Ford long to decide that the multi-story factory layout would not be as effective as a single floor assembly line. This problem would be amended in the building of the River Rouge factory. From

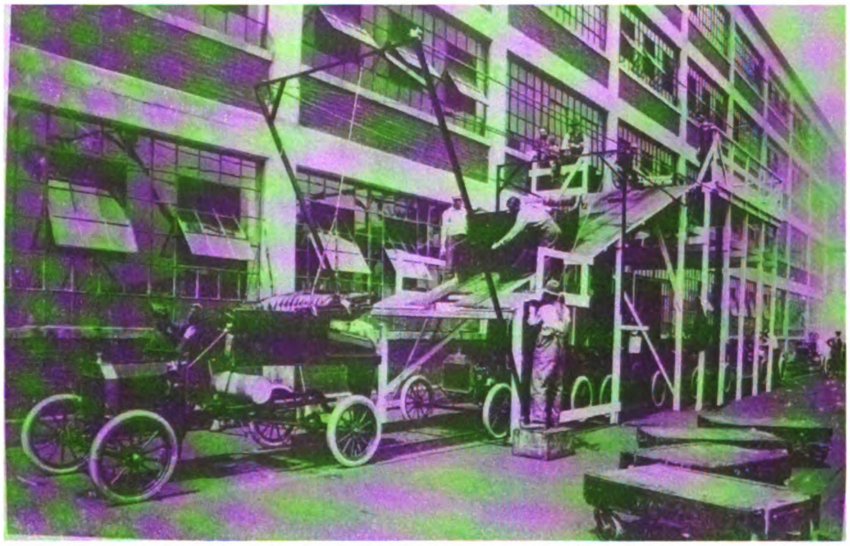

**Figure 3.4 Photo of the body-drop process, the first incarnation of the chassis assembly line. Due to the lack of room inside the factory, the chassis' were assembled outside the building.**

[10] "The Ford safety record was the best in the industry, and often the best in the country, as the National Safety Council recognized." *Allen Nevins, Ford: Expansion and Challenge*. The quote was featured in "Ford Facts, 1912-1959", Vertical Files, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.

[11] Photo courtesy of Albert Kahn Inc.

1914 on, nearly every operation within the factory would be converted, one at a time, over to the assembly line process, from the first bolt to the complete car.

While Henry Ford himself cannot be directly credited for the idea of the assembly line, his management of the factory can. Ford not only allowed experimentation but encouraged his employees on all levels to improve efficiency. In his 1956 memoir, Charles Sorensen stated, "The only things we did not do were those we could not think of."[12]

This environment of experimentation allowed Klann and many others the opportunity to move forward, and without that support these changes would not have happened when and where they did. This was Henry Ford's gift, the foresight to let his men's imaginations work, and of course, to benefit from that effort.

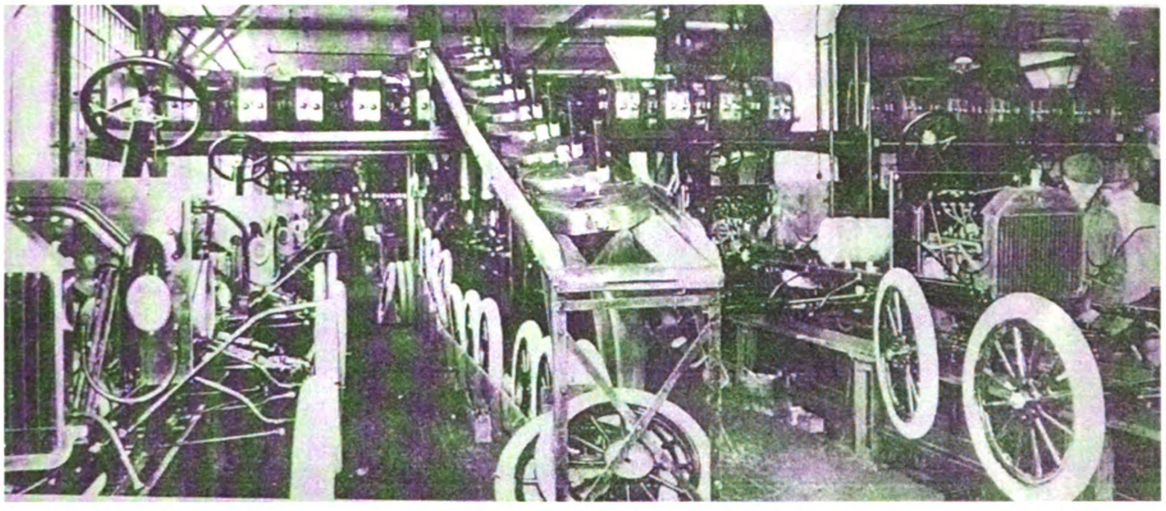

**Figure 3.5 Photo of the Model T chassis assembly line taken in 1914.**[13]

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[12] Charles E. Sorensen with Samuel T. Williamson, My Forty Years with Ford (New York: W.W. Norton, 1956): 142.

[13] Vertical Files, Albert Kahn, "Michigan History", The Benson Ford Research Center, The Henry Ford.

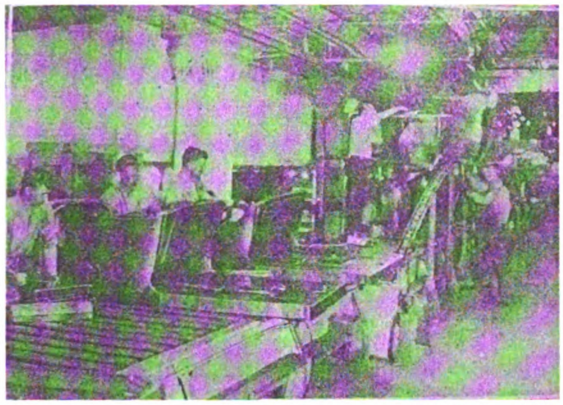

**Figure 3.6 The body is lifted by conveyor while on the chassis travels below.**

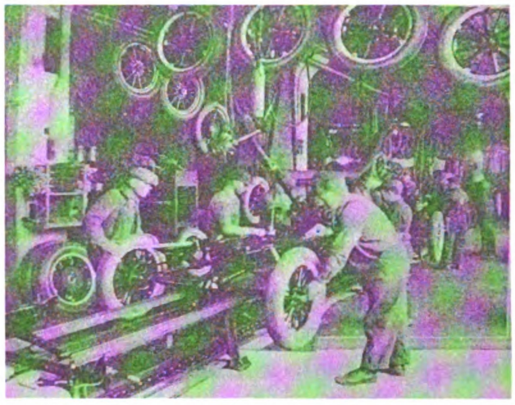

**Figure 3.7 Workers attach the wheels to the frame.**

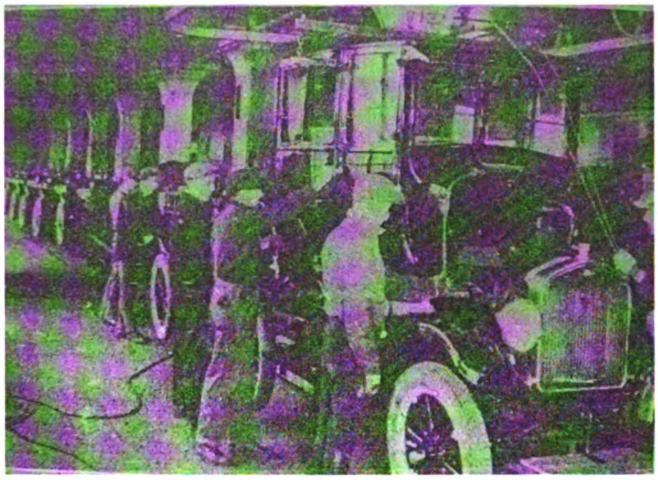

**Figure 3.8 One of the last steps in the assembly, attaching the body to the frame.**

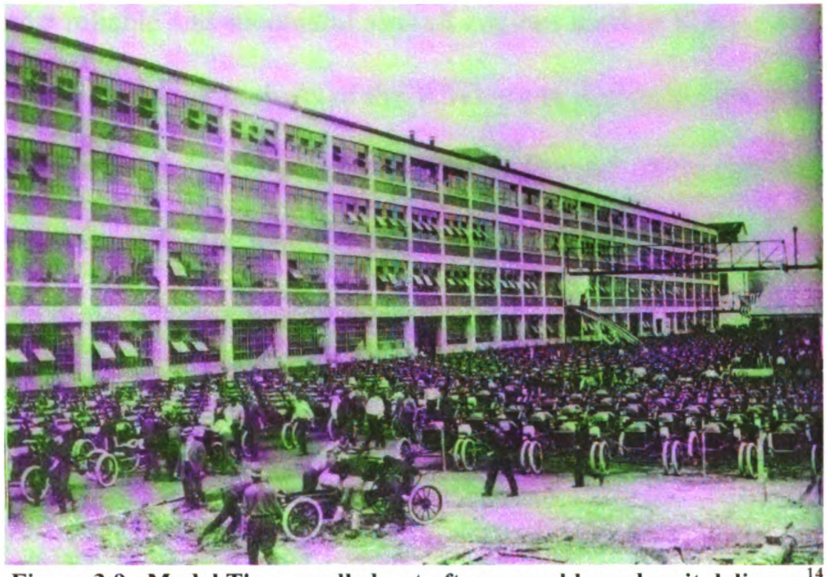

**Figure 3.9 Model T's are rolled out after assembly and wait delivery.**[14]

[14] Figures 6 through 9, Vertical Files, Highland Park, "Industry Illustrated", The Benson Ford Research Center, The Henry Ford.

*Highland Park's War Production*

With the outbreak of World War I in Europe, many American industrialists began to capitalize on the new demand for war goods, regardless of America's proclamation of isolationism. Henry Ford was not one of them. He had refused to help arm any of the fighting parties. This was to change with President Wilson's declaration of war in April of 1917. Ford then offered Wilson his full support.[15] Highland Park was to play a significant role in this endeavor and was to fill the first requests of the war for the Ford Motor Company; 2,000 ambulances to be sent to France. The company bought the necessary wood body parts, assembled them, and attached them to Model T chassis's at Highland Park. By the end of the war, the plant had an entire building full of ambulance parts left unused.

Ford had also offered to build fighter aircraft for the war department, but this offer was rejected. Instead, Ford was commissioned to build 5,000 "Liberty" aircraft engines, which would be constructed at Highland Park as well.[16] These engines were said to be some of the most reliable and successful aircraft engines used in WWI.

One of the more interesting projects of the WWI era at Highland Park was the Eagle project, described in great detail by historian Ford R. Bryan.[17] Although the project was transferred to the Rouge for the majority of its completion, its beginning was at Highland Park. The Eagle project came about after Henry Ford was named to serve on the shipping board by President Wilson. As part of the board, Ford suggested the production of a fleet of small, fast submarine chaser ships to combat the rapid destruction of allied cargo ships

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[15] Ford R. Bryan, *Beyond the Model T: The Other Ventures of Henry Ford* (Detroit: Wayne State University Press, 1990): 35.
[16] Ibid.
[17] Ibid., Ch. 3, 35-44.

(5-6,000 were sunk a year during the war). Although heavily fought by the shipping lobby, who did not want Ford involved with ship building, the contract was eventually given to the Ford Motor Company. Originally, the ship was intended to be a very simple, open air patrol boat, armed with depth charges and intended for three to four day missions. The plan was expanded however, by British Navy Commander and Ford furniture designer Sidney Houghton, to become a larger ship with bunks and accommodations suitable for longer missions. Ford was awarded the contract to produce the U.S. Navy's new experimental submarine chaser on January 18, 1918. The ship would be named the Eagle, a name claimed to have come from Ernest G. Liebold, Ford's general secretary who used it in an editorial for the Washington Post. The final design left the ship at 204 feet long and 33 feet wide. It would be outfitted with a three-inch antiaircraft gun, two four-inch guns, two .50-caliber machine guns. The ship was included a radio apparatus and sophisticated listening devices developed by Edison Laboratories and manufactured by Ford, for finding U-boats. Ford insisted that the hull be made of steel sheet for quicker assembly, and that the ship use a steam turbine power plant instead of a conventional reciprocating engine. The steam turbine power plant was much quieter, allowing the listening equipment to function more effectively and the ship to operate more stealthily. It would have a draft of eight feet, allowing enemy torpedoes to slip by underneath. Its top speed was nearly twenty knots, twice that of a submerged u-boat. The ship also had a sharp steel-encased nose, filled with solid concrete for ramming surfaced u-boats. The cost per ship was estimated at $275,000.00. A factory was being built at the Rouge plant for the production of the ships, but was not complete yet, so the first prototype would be built at Highland Park. Using Highland Park's six-story factory

building's open central craneway, the prototype was begun on February 17, 1918 and completed on June 24th. The prototype ship was bolted together rather than welded (Figure 3.10).[18] After completion it was disassembled and moved to the Rouge where it was welded and riveted permanently, and was officially launched as Eagle No. 7.

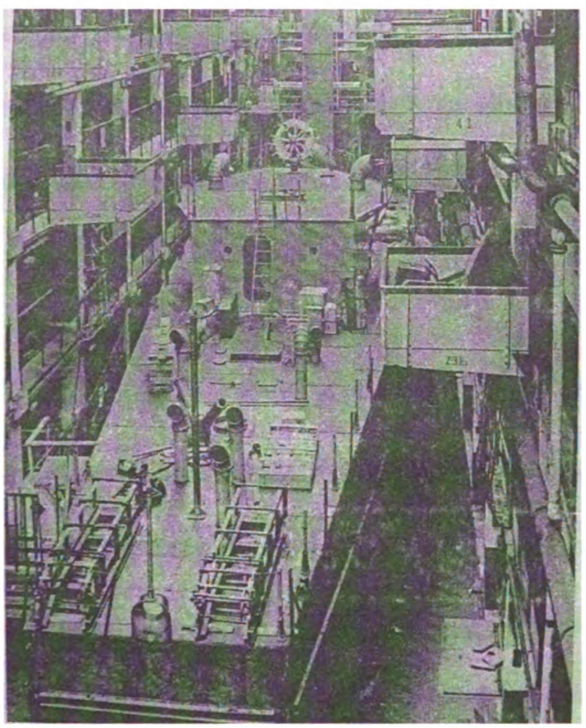

**Figure 3.10 Photo of the Eagle prototype being built in Highland Park's six story craneway.**

The ship's 2,500 hp oil-fired steam turbine engine's boilers, turbines, and reduction gearing would continue to be built at Highland Park. The parts were soon produced in numbers greater than were needed at the Rouge, attesting Highland Park's superb capabilities. By the end of the war 12 boats had been launched, and 7 commissioned by the Navy, although few saw any action. Regardless of their lack of action, reports by the Navy regarding the Eagle's performance appear to have been quite good. The ships served in various parts of the world including south-east Asia, the Caribbean, and Italy, and were used for naval training as well. According to Bryan, a few were even used by the government as rumrunners (there is no explanation of this curious usage), survey ships, lighthouse tenders, and internal revenue and customs services for the treasury department. The navy continued its contract past the war, but at a reduced rate of thirty ships rather than the original sixty. While serving in various duties, some went on to

[18] (833-22503), The Benson Ford Research Center, The Henry Ford.

serve in World War II as antisubmarine patrol off the east and west United States coasts, along with sonar training and target towing.

By 1917, the Highland Park plant had expanded to cover 305 acres, 88 of which were under one roof. It now included a chemical laboratory, a safety department and a profit-sharing department. It also began producing Ford tractors in this year, which would continue, on and off, until 1973.[19]

*The 1920's*

With the end of WWI and the beginning of the 1920's, Highland Park was to undergo another drastic change. While already a massive plant, it was now to become its own city, offering its employees a vast new array of services. The factory would provide a house and rental exchange, a grocery (right across from the pay office), meat, drug, and shoe stores, a tailor shop, lunch facilities, and a factory legal department to provide advice for employees. It also began a bonus and investment plan for employees on January 1, 1920. The factory even had its own newspaper called "Highland Park Ford News".[20]

Highland Park would also institute changes in safety and employee training. The factory now had a fire department which employed 90 experienced fire fighters in three shifts of thirty each, an apprentice school called the Henry Ford Trade School, which opened in October of 1916, and the Ford Service School which opened January 1, 1918. Even sick workers were accommodated. A tuberculosis sanitarium existed, which consisted of an outdoor manufacturing facility. This provided plenty of fresh air where

[19] "Ford Facts", 1912-1959, Vertical Files, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.

[20] "Ford Facts", 1912-1959, Vertical Files, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.

workers who were well-enough could still work and collect a pay check.[21] For the healthy, there was an athletic field and even a 60 piece band which traveled across the mid-west.[22]

The administration building housed an auditorium, photo gallery, post office, telegraph and telephone exchange, and even a movie theatre.[23] During the 1920's, 100,000 visitors a year came to see Highland Park.[24]

By 1924, fifteen years after construction, Highland Park was to reach its peak. With the Ford Rouge Plant now in full operation, many of the tasks once completed at Highland Park were to begin moving over to the Rouge. Highland Park was to function mainly as a huge machine shop, while the Rouge would focus mostly on raw materials. Highland Park would still produce tractor parts for the Rouge, and include a radiator department and a spring axle and steering department.[25] In 1924, Highland Park was also to reach its maximum employment, which numbered some 69,000 workers. This worker population was enough to make the factory itself the fourth largest city in Michigan.


**Figure 3.11 Henry and his son, Edsel Ford sit in the 15 millionth Model T produced at highland Park. It is currently on display at the Henry Ford Museum.**

The Model T would continue to be produced at Highland Park until 1927, when the 15

[21] Ibid.
[22] Wilson, "Giant of Industry".
[23] "Ford Facts".
[24] Wilson, "Giant of Industry".
[25] "Ford facts, 1924."

millionth Model T rolled off its line.[26] It was to be the last built at the great complex (Figure 3.11).[27] Today, some 300,000 Model T's are still in existence,[28] a number of which are still used today to give rides to visitors at Greenfield Village in Dearborn, Michigan.

Tractors would continue to be built at Highland Park until 1928, and then again from 1945 to 1973, when tractor assembly was then moved to a new factory in Romeo, Michigan. The Prince of Wales even came to tour the plant in 1924. At its height, the Highland Park complex covered 102 acres between Woodward, Manchester, and Oakland Avenues and the Detroit Terminal Railroad. It contained 20 buildings, covering 3 million square feet of floor space.[29]

The late 1920's witnessed more changes at Highland Park. In 1925, the factory began wool cloth manufacturing and dyeing. A glass plant, one of only four Ford operated, was begun in 1927.[30] In fact, many processes would continue to be completed at the complex. The factory still housed a machine shop, produced artificial leather, Fordite, textiles, radiators, steel bars, copper wire, roller bearings and batteries.[31]

By 1929, Highland Park's assembly lines had been moved to

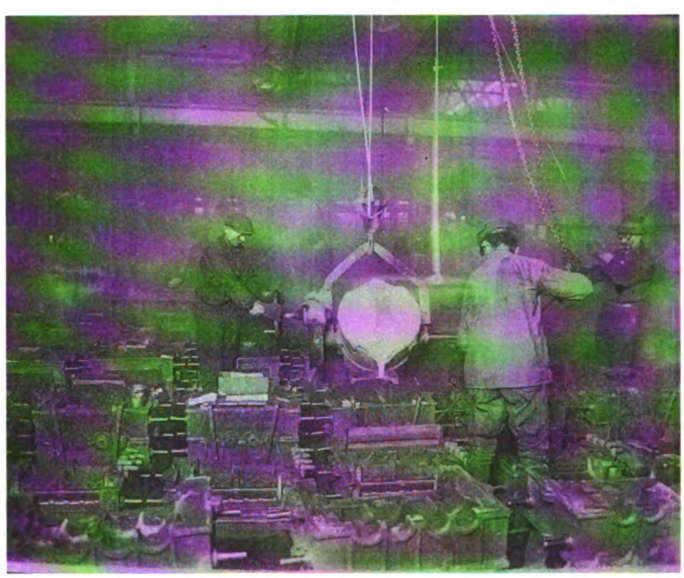

**Figure 3.12 Photo of men pouring hot cast iron into engine block molds in the foundry.**

[26] French, "New Industrial Society".
[27] Vertical Files, Highland Park, The Benson Ford Research Center, The Henry Ford.
[28] Wilson, "Giant of Industry".
[29] "Ford Facts".
[30] Ibid.
[31] Ibid.

the Rouge, but the factory remained quite active. It housed the second largest lacquer and paint manufacturing complex in the world. It also housed the world's largest forge (Figure 3.12)[32], and had the greatest assemblage of steam hammers in America. The factory also produced machinery, tools, and dies, and parts for the Rouge and Ford's assembly branches. It continued to employ some 14,000 employees. Later in 1929, the radiator plant would be moved to Green Island, New York, but up to that point, it had been the largest in the world while at Highland Park.[33]

*The Depression Era*

The thirties were a chaotic time for Highland Park. The factory would see both rises and falls in its operations. Many operations were by now being transferred to the Rouge. The trade school was also transferred in the fall of 1930, and the drop forge department in 1931. Part of plant complex was also leased to other companies in the thirties, such as the Briggs Manufacturing Company, which leased a portion in 1933. An increase in usage at Highland Park, by the Ford Motor Company was to come in May of 1935, as the first Ford automobile rolled of the reconditioned assembly line.[34]

While the factory began its decline throughout the 1930's. Regardless of production being shifted more and more to the Rouge complex, Ford managed to keep Highland Park running throughout the Great Depression. This was a feat unmatched by most of his competitors, including General Motors, which shut down many of their facilities during the depression. Ford even had welfare commissaries set up in the Detroit area, to provide relief to the poor. These commissaries were based on Highland Park's. They provided

[32] Acc. 1660, Box 131, Highland Park, "Foundry", The Benson Ford Research Center, The Henry Ford.
[33] Ibid.
[34] Ibid.

groceries, meats, medical care, fuel, and clothing on credit in specific areas that were hardest hit by the depression. Circumstance and residency in these specific areas were the only requirements for aid, and recipients gave I.O.U's for what they had received.[35] Commissaries also set up programs for people to help themselves. Ford did not like to just give people a free hand, but rather preferred to give people a chance to help themselves. People performed jobs around the community, made goods such as clothes from commissary materials, and prepared meals using commissary goods. All that was made went to those in need. Classes were also offered in sewing, canning, cooking, and other household arts. Ford's farms provided the tremendous amount of food goods offered at its commissaries during the depression, including the one at Highland Park. Goods such as fresh and canned vegetables were sold at low prices.[36]

Although it survived the depression, the Highland Park commissary was to close in January of 1942. Michigan Public Act 271 of 1941, forbade employers to sell items to its employees which it did not make or handle. A type of commissary remained operational throughout WWII at Highland Park, labeled "Ford Salvage".[37] While Michigan commissaries were officially shut down due to Michigan's government regulation, Ford's out-of-state commissaries based on the Highland Park model would continue to flourish for some time.

*World War II*

Leading up to World War II, Highland Park was to regain some of its former functionality. In a memo from the Ford Motor Company's Michigan Dealer's Department

[35] Bryan, *Beyond the Model T*, 221-223.
[36] Ibid.
[37] Ibid., 224.

dated January 9, 1940, the department responsible for servicing parts and accessories to dealers and service branches would be moved from the Rouge to Highland Park. The ground floor of the old foundry building was remodeled, giving the department 166,000 square feet of space. Four-hundred men from the department which had been scattered all over the Rouge would be transferred, piece-by-piece to Highland Park between January 15th and February 1st. The reason for this move was sighted as being more convenient for a majority of the dealers in the territory.[38]

Highland Park would again change course with the outbreak of WWII. Like much of America's industry, the factory would be converted into producing war goods once again. According to the article *Among Detroit Foundries* by A.H. Allen in November of 1942, Highland Park was to build M-4 medium tanks.[39] According to the article, the factory had been testing the thirty-two ton M-4 tanks on its test track, and Ford engineers were to make several significant changes to the tank. Their first innovation was to improve accessibility to the interior equipment, allowing quicker and easier servicing of the engine and mechanics. They were also to re-engineer the tank's 75mm main cannon's gun mount, allowing it to be made in three castings. This was a tremendous improvement over the former number of 27 castings. The tank's armor plating was to come from the Rouge. In June of 1942, the first tank rolled off the line. They were being produced at both the Highland Park and Rouge plants. Combined, the two plants produced 1,683 M-4 tanks, 1,035 M-10 tank destroyers, and 26,954 tank engines.[40]

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[38] Michigan Dealer's Department, Ford Motor Company, (January 9, 1940), Vertical File, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.
[39] A.H. Allen, "Among Detroit Foundries" *The Foundry* (December 1942), Vertical File, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.
[40] Nevins, *Ford, the Times*, 203.

Highland Park also produced aircraft parts for the war effort.[41] In 1943, production of B-24 nose side panels and fuselage tail cones was transferred to Highland Park.[42] Ford also received a contract to build 400 M-7 anti-aircraft gun directors in October of 1941. A school for the M-7 director was established within Highland Park, under the direction of H.J. Robinson, who was in charge of M-7 production. By July of 1943, 105 directors a month were being produced. The factory produced 805 in all, along with 400 for the less-complex M-5 anti-aircraft gun.[43]

The forties also saw the transfer of non-war production operations back to Highland Park. In 1945, tractor production was brought back from the Rouge, and all truck and bus production came back in April of 1946 with the goal of doubling production. The first bus rolled off the line on June 17, 1946. In February of 1947 truck assembly was begun, producing 43 different models at a rate of 400 daily. An electronically controlled, automatic body sorter moved the bodies to various feeder lines for assembly. A second shift was added to the truck assembly line in March of 1948, boosting production from 220 to over 300 a day.[44]

A management meeting in October of 1949 summarized the state of operations at Highland Park at the end of the forties. The plant employed 4,000 employees, manufactured tractors, paint, industrial engines, artificial leather, upholstery, tops, and service parts. Space was also being rented to Dearborn Motors, Park Motor Sales,

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[41] Peterson, "Ford Selling Factory".
[42] Ibid., 219.
[43] Ibid.
[44] "Factory Facts", 1945-1948.

Lawrence Technical College, Essex Wire and Parsons Manufacturing and Advertising Specialties.[45]

*The Cold War*

The making of war goods did not end at Highland Park with the end of WWII. During the 1950's Highland Park was to play a role in the production of Bazooka rockets. Production of the rocket was begun in June of 1951. In September of 1950, the Highland Park Division was established to oversee operations still in effect at the factory. Tractor assembly and parts made up the majority of operations during this time. A new NAA tractor program was to begin in 1952,[46] along with 8N tractor manufacturing and a tractor casting machinery department. Other tractor operations included the production of large and small iron casting machinery, differential pinion and gear assembly, and heat treatment.[47]

Another great change was announced in June of 1953, in which manufacturing and assembly functions would be reorganized. The factory's remaining operations of truck assembly, tractor manufacturing and assembly, trim manufacturing, rocket and parts machining, paint and artificial leather, would all be run as separate businesses. Truck assembly was to be renamed the Detroit Truck Plant, and managers would be assigned to each of the other divisions. By March if 1954, the Highland Park tractor plant employed 800 persons under Walter Nelson, while Highland Park operations under W.D. Singleton

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[45] Ibid., 1949.

[46] The NAA Ford tractor (NAA was the tractor's model number) was built from late 1952 to 1954, and marked the end of the model N8's production. 1953 was the Ford Motor Company's fiftieth anniversary so the tractor was called the Golden Jubilee. The NAA Jubilee had a more powerful engine than the N8, was taller, heavier and longer than the N8 and had live hydraulics and a redesigned front cowling.

[47] "Factory Facts", 1950-1952.

employed 7,800 persons for the rest of the plants operations. This was a far cry from the factory's heyday. Highland Park operations were cut further in 1955, down to 4,400 employees, and again in 1956, to 2,800 employees. That same year however, tractor employees were doubled to 1,600.

During this time, the plant lost some operations but also gained some new ones, such as the production of chemical products and industrial engines. This however, was the beginning of the end for Highland Park. It would never again employ large numbers of employees, as one by one, each operation was shipped to new factories. More and more of the complex would be leased to other aspiring businesses until the factory's final sale from Ford.[48]

*Henry Ford and the Soy Bean*

**Figure 3.13 Ford inspects a crop of soy beans at his experimental farm.**

One of Ford's most interesting innovations was to come in the 1930's. It is an innovation that is often overlooked, but has had substantial lasting effects. This was Henry Ford's fascination with the soybean (Figure 3.13).[49] To say Henry Ford was ahead of his time is an understatement. In a time when environmentalism and renewable resources have become the discussion of nightly news the world over, Ford's experimentation with agricultural produce has become even more impressive.

[48] Ibid., 1953-1956.
[49] Vertical Files, "Soy Beans 1930's", The Benson Ford Research Center, The Henry Ford.

> Mr. Ford was forty-five years ahead of today's ecologists. He was committed to improving the lot of the farmer, and he was convinced that you should find industrial uses for agriculture crops. He predicted back then that the day would come when automobiles would 'grow' on farms.[50]

These were the words of Joseph Crup, a Ford engineer who once worked at Ford's research laboratory in Greenfield Village, and he was certainly right.

Henry Ford was the son of a farmer. He began building tractors shortly after his success with the Model T, and continued to do so throughout his life. His passion for helping the farmer ran deep and Ford spent many hours at the wheel of his tractor, and spent a fortune on agricultural development.

One area in particular would find a home at Highland Park and prove yet again Ford's ability to think ahead of his time. This was his experimentation with the soy bean. Ford collected land. This land was not just for industry, he also purchased huge tracts for farming. His collection included 26,000 acres of farm and hydroelectric property in southern Michigan alone.[51] Ford owned so much that his buying agent Fred Gregory often had to remind him, when proposing to buy a new property, that he already owned it.[52] Ford also kept a close eye on the happenings at his farms. Historian Ford R. Bryan states,

> The farmland in southern Michigan is of particular interest because it was managed in detail by Ford himself. His foreman received instructions almost daily about what to plant, where to plant, and when to plant, as well as when and how to harvest. And Ford was often there to see how it was done. He had been

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[50] Brinkley, *Wheels for the World*, 443.
[51] Bryan, *Beyond the Model T*, 107.
[52] Ibid.

> experimenting with farm crops from the time he had started to experiment with tractors-about 1906.[53]

With his intense interest in all things agricultural and the means by which to do so, it comes as no surprise that in 1929 Ford set up an experimental laboratory in Greenfield Village to explore agricultural possibilities and to enhance agricultural techniques. This would become center stage for the development of the soybean. Ford brought in Robert Boyer, a young self-taught chemist to head up the operation, along with a dozen young men from the Highland Park trade school. These men set about experimenting with nearly every known vegetable and legume in an attempt to discover new possibilities that could be derived from them. Historian Steven Watts states, "Ford and Boyer would brainstorm about different possibilities, and the next morning a truckload of carrots or tomatoes would be dumped in front of the lab for processing."[54]

Watts also states that Ford even suggested experimentation with hemp, not knowing that it was marijuana. After pulling some strings to get a license, he had his men plant seven acres of marijuana behind Moir House, right in Greenfield Village. An hourly patrol was implemented to protect the plants from would-be thieves.[55] The efforts did pay off on a minor level however, as some hemp was used in the making of the first plastic car.[56] Hemp however was not to become Ford's focus.

According to Michael W.R. Watts, in his article "Plastic Fords",

> One day in 1931-as Bob Smith, one time manager of the Ford Farms recalls-Mr. Ford wandered into the laboratory and picked up a book (The Soybean by

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[53] Ibid., 108.
[54] Steven Watts, *The People's Tycoon: Henry Ford and the American Century* (New York: Alfred A. Knopf, 2005): 483.
[55] Ibid.
[56] Ibid., 443.

C.V. Piper and W.J. Morse) which he then sat down to read from cover to cover. When he finished, he ordered his people to 'throw everything you are working on out' and to work exclusively on the soybean.[57]

While the soybean was virtually unheard of in the United States at that time, it had been used for thousands of years in Asia. In an interview for Rotarian Magazine in September of 1933 titled *Automobiles and Soy Beans*, Ford explains his interest in the bean.

> As to soy beans, I have no particular bias for these little legumes, although I do believe they are the result of several thousand years of experiment by wise men of Asia. I would just as soon talk about celery, or turnips, or watermelons, if experiments show them to have materials suitable for industrial use. It happens that just now soy beans display the broadest possibilities. And it is only as an example of what can be done, that we ever consent to discuss our experiments.[58]

Ford ordered the planting of some three hundred different varieties of soy beans on almost seventy-four hundred acres of his farm land.[59]

With the onset of the great depression, any effort to help the farmer came as a sign of relief, and Ford's experiments with the soy bean caught national attention.

**Figure 3.14 Photo of Ford workers harvesting soy beans.**

Ford stated in a 1933 interview with Arthur Van Vlissingen Jr., that due to the improved production of American farms and the state of the

[57] Michael W.R. Davis, "Plastic Fords" *Special-Interest Autos* (June-July 1972): 18-19, Vertical File, Soybean Articles, 1970's, The Benson Ford Research Center, The Henry Ford.
[58] Arthur Van Vlissingen Jr., "Automobiles and Soy Beans" *Rotarian Magazine* (September 1933):3, Vertical File, Soybean Articles 1930's, The Benson Ford Research Center, The Henry Ford.
[59] Bryan, *Beyond the Model T*, 112.

economy during the depression, a vast surplus of agricultural goods was present. His solution: "The best way to handle a surplus is to invent new uses for it."[60] Up to that point, the soy beans were mainly pressed for oil to make soaps and paints. The remaining cake could be used as feed for cattle due to the bean's high protein content. The soybean also had other benefits for the farmer. It was able to grow nearly anywhere in the world, needed little cultivation, and could be harvested at any time of the year. This is possible because the beans dry on their vines, standing straight-up above the ground, preventing deterioration (Figure 3.14).[61] Ford stated, "The crop may be harvested any time during the winter; this enables the farmer to employ his time profitably during the months when work is lighter. Some of our crop was harvested in sub-zero weather last December."[62]

The processing of the soy bean into oil was also simple and cheap, allowing the farmer to take the first steps of processing at his own farm. This left him able to sell the oil and feed the meal to his livestock. Because all this could be done in the winter months, the farmer had access to an income when times were most scarce.

The production of the soy bean into a usable form was fairly straight-forward. There were three ways to extract oil from the bean: the use of high-pressure expellers, hydraulic pressing or solvent extraction. Ford would focus on

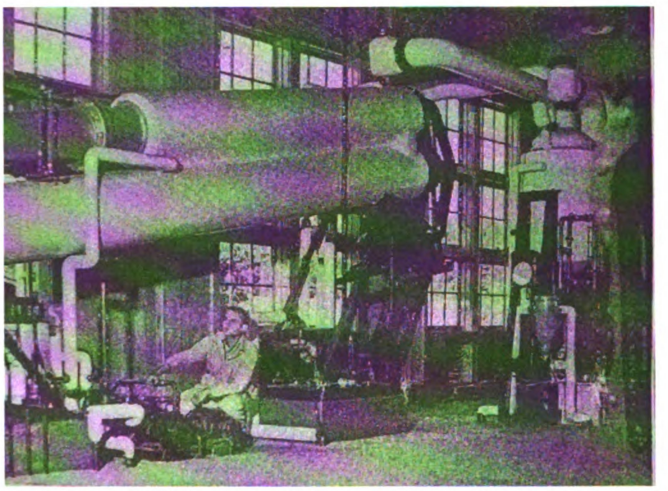

**Figure 3.15 Photo of the extracting plant in Saline, which was capable of extracting 140,000 bushels of soy beans a year.**

[60] Van Vlissingen Jr. "Automobiles and Soy Beans":2.
[61] Vertical File, Soybean Articles 1930's, The Benson Ford Research Center, The Henry Ford.
[62] Ibid., 5.

solvent extraction, which yielded the highest content of oil from the bean, at less cost, and the oil was of a better quality.[63] The best example can be found in the workings of Ford's village industry in Saline, Michigan (Figure 3.15).[64] Ford reconditioned an old mill for the production of soy beans in 1938.[65] While the method of extraction became more efficient, the system was virtually the same as that used when experimentation first began. First, the soy beans were delivered by truck to the mill and dumped into hoppers. The beans were moved on a conveyor to the second story for cleaning and then put into storage bins on the upper stories. When the mill was ready to process, the beans were transported to

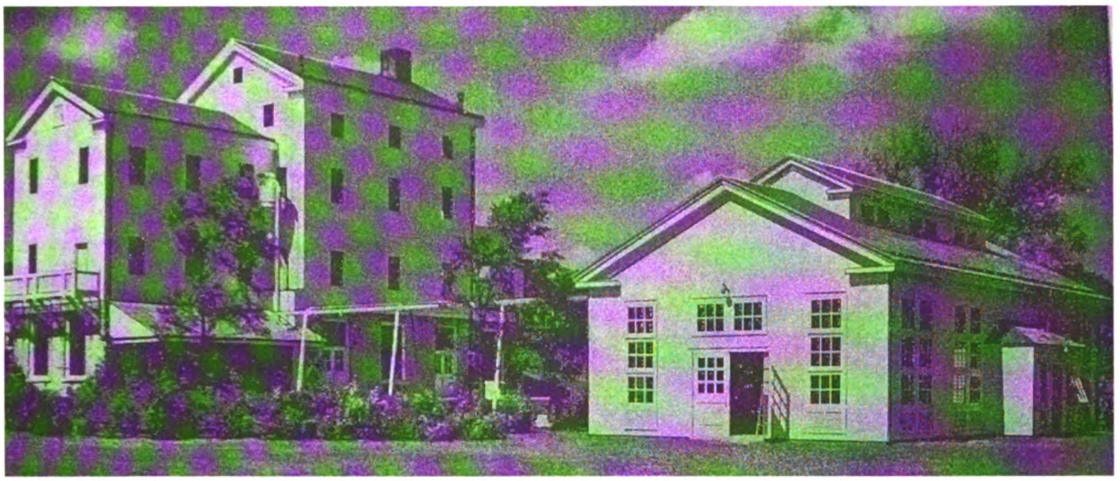

**Figure 3.16 Photo of the Soy Processing Mill, one of Ford's Village Industries in Saline, Michigan.**

the extraction plant at the rear of the mill (Figure 3.16).[66] They were put into a hopper, flaked, and then put into an extractor. Using the liquid solvent hexane, oil was extracted

[63] "Use of Soybean Products Increasing Rapidly" *Chemical & Metallurgical Engineering*, Vol.43, No. 4, Vertical File, Soybean Articles 1930's, The Benson Ford Research Center, The Henry Ford.
[64] Vertical File, Soybean Articles 1930's, The Benson Ford Research Center, The Henry Ford.
[65] "A New Farm Market" *Ford News*, (September 1938): 195-196, Vertical File, Soybean Articles 1930's, The Benson Ford Research Center, The Henry Ford.
[66] Vertical File, Soybean Articles 1930's, The Benson Ford Research Center, The Henry Ford.

and the hexane was recovered from the oil simply by evaporating the solvent. The Ford News described the process of extraction,

> The extraction process takes place in a large insulated tube set at an angle of ten degrees with the floor. A screw conveyor operates inside the tube, carrying the bean flakes from the bottom toward the top as the solvent pours down. The solvent carrying the oil is drawn off from the base of the tube and run through evaporators where the solvent passes off as vapor and oil remains. The solvent is used over again.[67]

It is from this point that the oil and meal can be made into usable materials. Ford explains its uses in his 1933 interview.

> Our chemists began to study soy beans from many different angles. For one, they discovered that the oil extract is quite as effective for mixing with sand to make foundry cores as linseed oil." "So far we have used a good many thousand gallons in this way and at present market prices, this means a substantial saving in core oils.[68]

**Figure 3.17 Photo of soy plastic being extracted into door handle parts.**

Ford also praises its use as a molding compound. He states, the resinous materials which are formed into such small parts as the button you press when you sound the horn, the ball on the top of the gear-shift lever, and so on. This residual meal proved excellent for the purpose.[69]

Many of these small plastic parts were used in the automobiles and tractors produced at Highland Park (Figure 3.17).[70]

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[67] Ibid.
[68] Van Vlissingen Jr. "Automobiles and Soy Beans":4.
[69] Ibid.

One particular soy bean product was to be processed directly at the Highland Park complex. This was the production of soy-based paints, which would become a huge part of the plant's operations. The soy bean oil was produced into a synthetic resin which was then made into enamel. The effectiveness of this paint was questionable in the beginning, as different sources sight both its great qualities and its drawbacks. While soy bean oil alone has poor drying qualities, it does have permanent elasticity and does not discolor. It can also be mixed with other oils to improve its performance.[71] Engineers experimented with various blends and were eventually successful in creating a highly effective automobile paint. This paint appears to constitute the largest amount of soy based material Ford would use in his operations, a great deal of which would be produced at Highland Park. Arthur Van Vlissingen Jr. states, "Exhaustive tests prove this enamel superior to lacquer in every respect, from original gloss to its complete resistance to deterioration. It costs less by the gallon, uses less to the job, saves tremendously on labor."[72]

As of 1933, the use of soy-based materials had made their way into the mass production methods of the Ford Motor Company. Ford stated, "About fifteen pounds (of soy bean oil) are needed for finishing one of our cars. Think what this signifies as an outlet for farm products when the new enamel becomes standard for the industry, as it probably will!"[73]

The 1934 Chicago's World Fair would play host to Ford's new enterprise. The "Industrialized American Farm" was on display, in which soy beans were processed into

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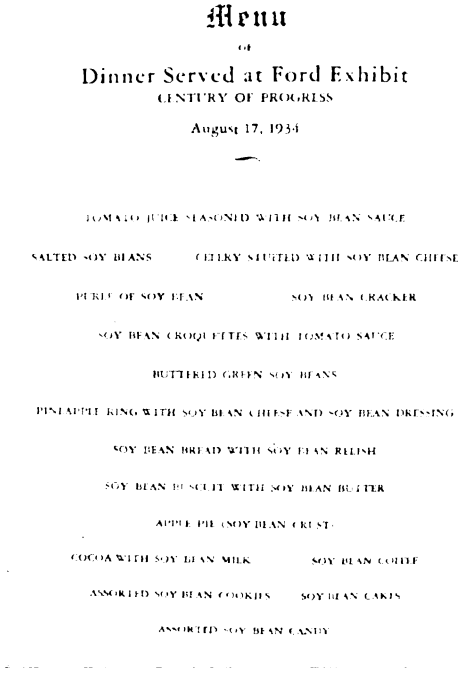
[70] Vertical File, Soybean Articles 1930's, The Benson Ford Research Center, The Henry Ford.
[71] "Use of Soybean Products".
[72] Van Vlissingen Jr. "Automobiles and Soy Beans":4.
[73] Van Vlissingen Jr. "Automobiles and Soy Beans":5.

oil and meal. Oil was made into paint, taking the place of linseed oil, and meal was used to make plastics and feed cattle. All of these processes, including the cows, were on display to the public.[74]

Ford did not just limit his fascination with the bean to industrial purposes, but was a great advocate of soy beans for human consumption as well. The soy meal could be made into a variety of food stuffs. Another soy lab was set up under Dr. Edsel Ruddiman. The problem was that soy bean meal had a terrible taste. Ruddiman's early try at creating human soy-food was a biscuit, but its success was as bad as its taste. A Ford associate described it as "the most vile thing ever put in human mouths."[75] The scientist did improve the use of soy meal, with varying degrees success, but were eventually able to create a large variety of food products. Ford also encouraged his scientists to develop a type of soy milk, stating "we've gotten rid of the horse, now we've got to get rid of the cow."[76]



Menu

of

Dinner Served at Ford Exhibit

CENTURY OF PROGRESS

August 17, 1934

TOMATO JUICE SEASONED WITH SOY BEAN SAUCE

SALTED SOY BEANS CELERY STUFFED WITH SOY BEAN CHEESE

PUREE OF SOY BEAN SOY BEAN CRACKER

SOY BEAN CROQUETTES WITH TOMATO SAUCE

BUTTERED GREEN SOY BEANS

PINEAPPLE RING WITH SOY BEAN CHEESE AND SOY BEAN DRESSING

SOY BEAN BREAD WITH SOY BEAN RELISH

SOY BEAN BISCUIT WITH SOY BEAN BUTTER

APPLE PIE (SOY BEAN CRUST)

COCOA WITH SOY BEAN MILK SOY BEAN COFFEE

ASSORTED SOY BEAN COOKIES SOY BEAN CAKES

ASSORTED SOY BEAN CANDY

**Figure 3.18 A copy of the soy foods menu offered at the World's Fair.**

Ford himself seemed to enjoy the soy products, tending to eat them along with other vegetarian meals often. Ford even served entire soy meals at his Fairlane home.[77] The exposure of soy foods to the world however, would come at the World's Fair. An entire

[74] Bryan, *Beyond the Model T*, 113.
[75] Watts, *The People's Tycoon*, 485.
[76] Ibid., 484.
[77] Ibid., 165.

dinner menu made from soy, was served at the Ford exhibit (Figure 3.18).[78] It included a variety of appetizers such as toasted soy beans, soy bean crackers, celery stuffed with soy beans, soy sauce flavored tomato juice, soy bean croquettes, soy bean bread, soy bean biscuit (hopefully an improved version), apple pie with soy crust, chocolate soy milk, soy coffee, and soy bean cookies, cakes and candy.[79]

Shortly after the fair, in May of 1935 Ford held the first Dearborn Conference of the National Chemurgical Council. Chemists from around the country came together in Dearborn to discuss the possibilities of agricultural produce development.

Ford was also to make an important acquaintance through the bean, which would lead to a long and close friendship. George Washington Carver, head of the Tuskegee Institute, was the leading scientist of his time in the field of agricultural development. Carver, a former slave, had gained fame for his introduction of the peanut to the south. The two men quickly became friends and held a great mutual respect for each other. Carver once wrote in a letter to Ford, "Two of the greatest things that have ever come into my life have come this year. The first was the meeting of you, and to see the great educational project that you are carrying on in a way that I have never seen demonstrated before."[80]

Ford finally managed to talk Carver into coming to work in Dearborn on developing a synthetic rubber, at a laboratory built into the old Dearborn Waterworks

**Figure 3.19 Henry Ford dressed in a suit made of soy fabric.**

[78] Vertical Files, Soybeans, General, The Benson Ford Research Center, The Henry Ford.
[79] A copy of the original menu can be seen at The Benson Ford research Center, Vertical File, Soybeans General, Folder 1 of 2.
[80] Watts, *The People's Tycoon*, 444.

building in 1942. The two men worked closely together until Carver's death in 1943.[81] It was during this time that Ford's scientist began to develop new industrial uses for soy beans, which would come to be used at Highland Park. Along with the great use of soy-based paint for cars, trucks and tractors, photographs show the production of soy textiles.[82] The soy-based textiles were first put on display at the New York World's Fair in May of 1939. It was the first time a textile was spun from a vegetable source in the United States. Ford himself would often wear soy neckties, made of a combination of soy, wool and silk fibers, and even donned a complete suit of soy material in 1941 (Figure 3.19).[83] The production method was amazingly innovative. The soy protein was combined with various chemicals to produce a molasses-like substance. It was then forced through a spinneret, which molded the liquid into threads the thickness of a human hair (Figure 3.20).[84] They were then spun into a thicker single thread the thickness of typical sewing thread. The thread could then be dyed. The feel of the material was reported in an article from the New York Times, "skeins, on display at the Ford exhibit, seemed, to the touch, of about the consistency and texture of a silk-and-wool mixture, and apparently had considerable tensile strength."[85] The intended use of the soy-material was for upholstery in Ford automobiles. This use however was interrupted by the Second World War. According to an article in RayonTextile Monthly in November of 1942,

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[81] Ibid.
[82] Acc. 1660, Box 131, Interior Machinery, 0-2486.
[83] 188-29410, The Benson Ford Research Center, The Henry Ford.
[84] Vertical File, Soybean Articles 1940's, The Benson Ford Research Center, The Henry Ford.
[85] "Ford Soy Bean Textile Tests Spur New Factory-Farm Link" *The New York Times*, (May 17, 1939), Vertical File, Soybean Articles 1930's, The Benson Ford Research Center, The Henry Ford.

Ford's soy bean yarn was also being used in army goods. The article mentions that a new processing plant was being built near the River Rouge works. It is possible that the experimental plant featured in the article was housed at Highland Park. A photograph of a soy-textile spinning machine at Highland Park matches the equipment featured in the article, as does the photograph's date (Figure 3.21).[87] The article states that this soy production laboratory was intended to be moved into the new processing plant upon its completion. The article states that due to a shortage of wool imports because of the war, soy material substitutes were needed. While it could not disclose details of the uses of soy bean yarn for the armed services, it did note that Ford was producing blankets and overcoatings (no description of this particular article was

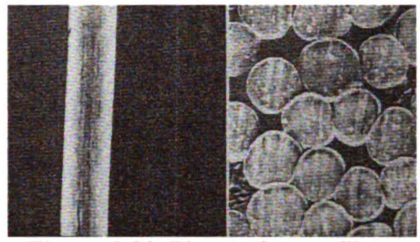

**Figure 3.20 Photo of a soy fiber magnified at x700.**

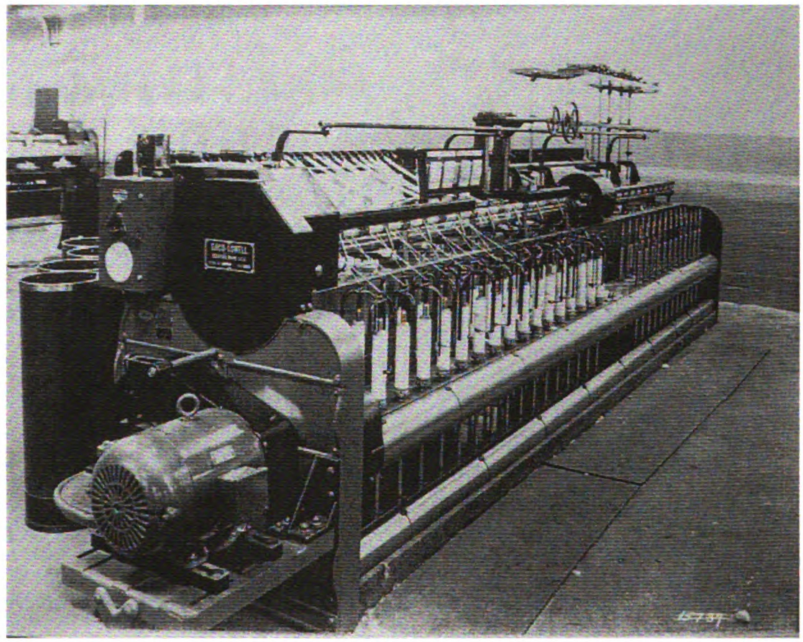

**Figure 3.21 Photo of the soy fiber processing machine at Highland Park.**

[87] Acc. 1660, Box 131, Highland Park, Machinery, 0-2486, The Benson Ford Research Center, The Henry Ford.

included in the article) with soy yarn. The article also states that the company was experimenting with some types of soy-yarn uniforms, to replace the use of wool. Mr. Boyer stated in the article, that the one hundred percent soy fleece material was slightly warmer than pure wool.[88] Soy bean oil was also being used as a substitute during the war for cocoanut oil, which had become nearly unavailable due to Japanese control of the areas where cocoanut oil mostly originated.[89]

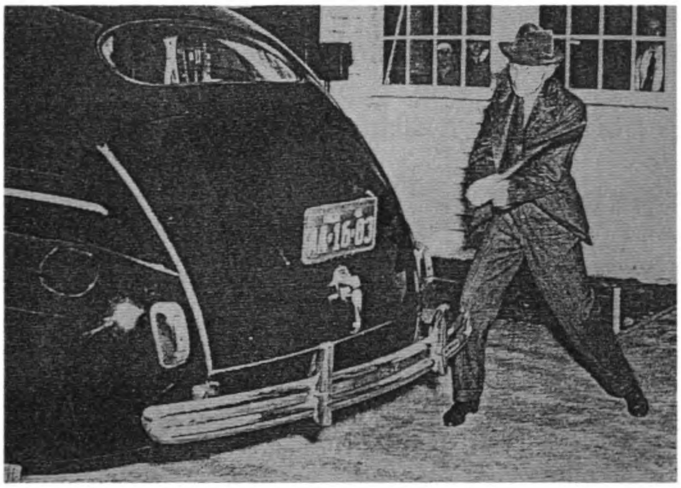

**Figure 3.22 Henry Ford takes an Axe to a plastic trunk lid in front of the press in 1941.**

One of the most interesting projects to come from Henry Ford's experimentation with soy beans was the production of a plastic car. Soy bean meal had already been made into small plastic parts such as gear shift knobs, light switches and accelerator petals, and displayed at the 1934 Chicago World's Fair. The first press exposure of the plastic car project was the famous trunk lid. This part was made entirely of plastic, but was not soy-based. Along with Ford's experimentation with soy plastic, other forms of plastic were also being developed. The article by Michael W.R. Davis stated, "Oddly enough, the soybean really played no role in the famous Plastic Ford of 1941, although the research led the enterprising young researchers into other types of plastics".[90] This new plastic would be used to make Ford's experimental plastic car. The

[88] Lloyd Stouffer, "Development of Soybean Fiber by Ford" *Rayon Textile Monthly,* (November 1942): 45-48, Vertical File, Soybean Articles 1940's, The Benson Ford Research Center, The Henry Ford.
[89] Davis, "Plastic Fords", 19.
[90] Ibid.

first piece of the plastic car that was developed was a trunk lid. Henry Ford himself took an axe to at a press conference to demonstrate the strength of the material, which of course, did not dent. Ford declared, "I wouldn't be surprised if our (plastics) laboratory comes to be the most important building in our entire plant." (Figure 3.22)[91]

Next came a car with a completely plastic body, which would be first displayed at a Dearborn festival in August of 1941. The final step was to design a car made entirely of plastic. In an interview in the Toronto Star in 1973, Robert A. Boyer discusses the plastic car project. "We decided to design a car from the ground up and to style it especially for plastics,", "In appearance, it is not radically different from steel models, but some angles were eliminated."[92]

The frame was to be made of a very strong tubular plastic which would weigh less than 250 pounds, much like a modern race car chassis (Figure 3.23).[93] Because of the lighter weight, the car could be powered with a smaller and lighter engine and lighter running gear. The body was made up of only thirteen panels and the entire car was thirty percent lighter than a regular car. Mass production of the plastic car was never to come into fruition however, as Ford passed away in 1946, before normal automobile production had restarted after the end of WWII (Figure 3.24 and 3.25).[94]

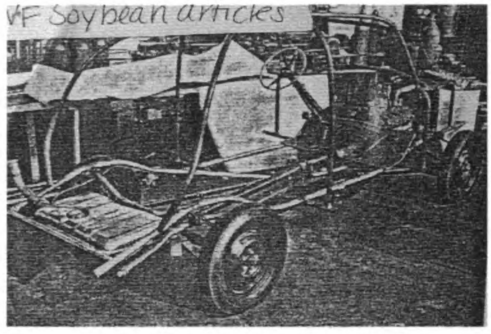


**Figure 3.23 Photo of the tube frame of the plastic car complete with built-in roll bars.**

[91] Ibid.
[92] Ibid.
[93] Vertical File, Soybean Articles 1940's, The Benson Ford Research Center, The Henry Ford.
[94] Vertical File, Soybean Articles 1940's, The Benson Ford Research Center, The Henry Ford.

The article states, "According to the Ford Motor Co., it was just one of many ideas 'which got lost in the files'."[95]

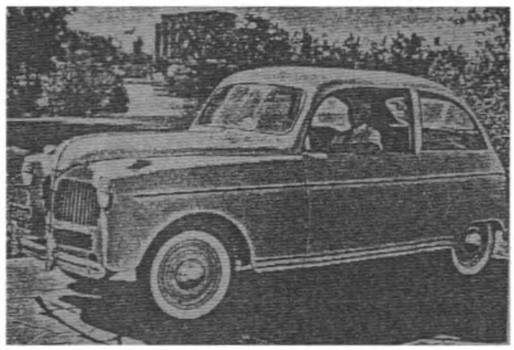

**Figure 3.24 Photo of the plastic car, driven by its designer Lowell Overly. The phenol-formaldehyde based plastic was said to leave the car smelling like a mortuary.**

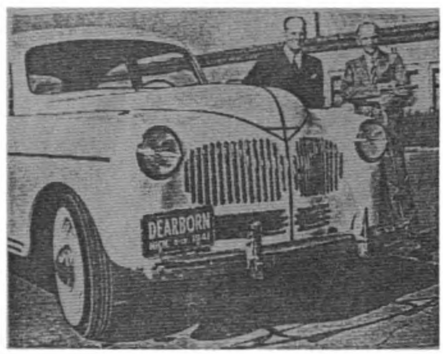


**Figure 3.25 Photo of Henry Ford and Robert A. Boyer in front of another plastic car made of cellulose plastic with plexiglas windows.**

While the plastic car did not have the lasting effect Ford hoped for, the research on soy beans his company fostered certainly has. According to William Shurtleff and Akiko Aoyagi, leading historians in the history of the soy bean and soy foods,

> Most Americans recognize Henry Ford's great contributions in developing the automated production line and putting America on wheels. But few are aware of the many contributions he made in transforming the soybean into one of America's most important farm crops.[96]

According to Shurtleff and Aoyagi, Ford accomplished twelve major feats in the realm of soy beans: he transformed it from a minor to major crop in America, introduced it to mainstream America, played a leading role in the farm chemurgic movement, pioneered solvent extraction of soybeans and soy protein isolates, popularized the use of soybeans

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[95] Ibid.

[96] William Shurtleff and Akiko Aoyagi, "Henry Ford and His Researcher's Work with Soybeans, Soyfoods, and Chemurgy-Bibliography and Sourcebook, 1921-1996", (Manuscript), Reference, 016.664726 F699 S562 199, The Benson Ford Research Center, The Henry Ford.

as food in America, pioneered textured soy flour, Textured Vegetable Protein (TVP)[97], soy based non-diary whip toppings, soy milk, soy ice cream, soy meat alternatives, and developed soy fibers to replace wool and fur. Many of Ford's soy experiments are still used today, both within and beyond use for industry. Soy-based fabric has made a recent comeback, examples of which can be found in many clothing stores today.

Ford's innovation can also serve as a lesson for future generations in the use of renewable resources, as well as an example of making possible that which seems impossible. There is no better example of Ford's ability to think beyond his time than his work with soybeans, and although Highland Park played a minor role in this story, it did see to one of the most useful and long-lasting effects of soy experimentation in its production and use of soy-based paints. As to the extent of which Highland Park played a role in other soy accomplishments as well as future soy projects, the evidence to date, is uncertain.

It is hard to imagine what might have come next, had Ford lived longer, and what other advances Highland Park may have played role to. Ford's vision for the future can best be seen in his own words,

> We do not yet know how much of the modern automobile can be grown annually on the farm to conserve the products of mines and forests. We know more about it today, however, than we did five years ago. We have been experimenting each year with new ways in which to employ farm products profitably. Indeed as every week discloses new opportunities of exploitation, we are sure only of one conclusion: No matter what we may guess as to the

[97] Textured Vegetable Protein, also known as Textured Soy Protein, is a by-product of making soy oil and is used as a meat substitute.

> proportion of automobile parts that can be built from the fruit of the field, our guess will fall far short of the eventual result.[98]

The image of the SAAB commercial where the car is built from nothing in a field, and returns to nothing, comes to mind. Henry Ford would have liked that.

[98] Van Vlissingen Jr. "Automobiles and Soy Beans":6.

# Chapter Four
## Glass and Steel: The Innovative Architecture of Highland Park

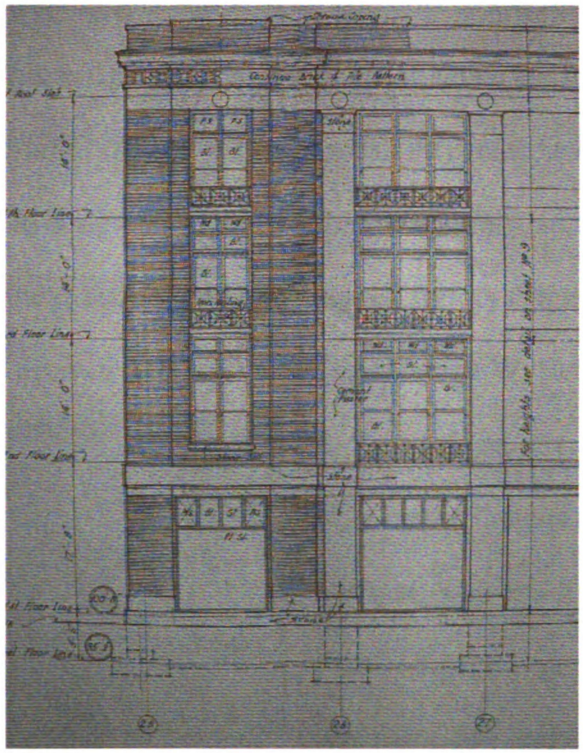

**Figure 4.1 Detail of the Sales Building blueprint showing the front facade.**[1]

*Albert Kahn and Highland Park*

There were several similarities between Albert Kahn and Henry Ford that no doubt helped to form the long business relationship and friendship the two men shared. They were close in age, both self-taught, and self-made men. Kahn began work in his industry at the age of fifteen, never completing his education, much like Ford. He also began his career in Detroit just as Ford had.[2] Their friendship would even survive Ford's anti-Semitic articles featured in the Dearborn Independent in the 1920's. Kahn, who was

[1] Job 375 BE, courtesy of Albert Kahn Inc.
[2] For a more extensive comparison of Henry Ford and Albert Kahn see Federico Bucci, *Albert Kahn: Architect of Ford* (New York: Princeton Architectural Press, 1993): 39-40, and Grant Hildebrand, *The Architecture of Albert Kahn* (Cambridge: The MIT Press, 1974): 43-44.

Jewish, was building the Rouge plant when the articles were first published, but kept working for Ford. It also appeared that they preserved their friendship through this time as well.[3] Throughout his life, Kahn was also an avid collector of art, and this love of the subject would show in his design of buildings, some of which are still considered among the most beautiful ever built.[4] Kahn's aesthetic sensibility must have been pleasing to Ford, who chose Kahn to design his highly decorative administration and sales buildings at Highland Park after the construction of the original factory (Figure 4.2).[5]

In 1895, Kahn began his own firm with associates George W. Nettleton and Alexander B. Trowbridge, after turning down a job offer by the famous architect Louis Sullivan, who was looking to replace Frank Lloyd Wright.[6] This firm, however, was not to last long, as Trowbridge accepted a teaching position at Cornell and Nettleton died in 1900. Kahn thereafter, joined with his first employer and mentor George D. Mason, until 1902, and then with Ernest Wilby until 1918.[7] It was during this latter partnership that Highland Park would be built.

**Figure 4.2 Photo of Albert Kahn in his Detroit office circa 1941.**

The reason Henry Ford chose Kahn as an architect for Highland Park, had a great deal to do with a new process of building patented by Albert Kahn's brother Julius. Five years

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[3] For more on Ford's Anti-Semitism see the collection of articles by Henry Ford, *The International Jew* (Garden City: 1921), and A. Lee, *Henry Ford and the Jews* (New York: Stein and Day, 1980).

[4] Kahn was a passionate collector of cutting edge and impressionist art. For more on his collection see "Albert Kahn", *Panache Magazine*, 6 (December 1998): 30-33. Albert Kahn Vertical File, Benson Ford Research Center, The Henry Ford. Kahn was also a fine artist himself. Some of his original work can be seen at the University of Michigan's Art Museum and in the office of Albert Kahn and Associates in the Albert Kahn Building in Detroit.

[5] Vertical File, Albert Kahn, "Michigan History", The Benson Ford Research Center, The Henry Ford.

[6] Douglas Brinkley, *Wheels for the World* (New York: Penguin Group, 2003): 136.

[7] Federico Bucci, *Albert Kahn: Architect of Ford* (New York: Princeton Architectural Press, 1993): 29-30.

younger than Albert, and educated in engineering at the University of Michigan, Julius was able to develop a building technique patented as reinforced concrete construction (Figures 4.3 through 4.6).[8] Federico Bucci describes the technique in his book *Albert Kahn: Architect of Ford.*

> The system of reinforcement was composed of a steel skeleton supported by soldered wings angled upwards, which, positioned according to the direction of the principal forces of compression, had the advantage of offering greater resistance while also simplifying the construction. [9]

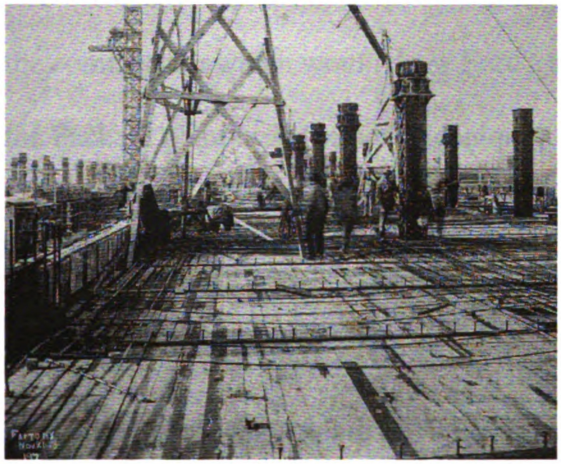

**Figure 4.3 Photo of the construction of Highland Park in 1913. The floor was first constructed of wood and steel support braces were laid.**

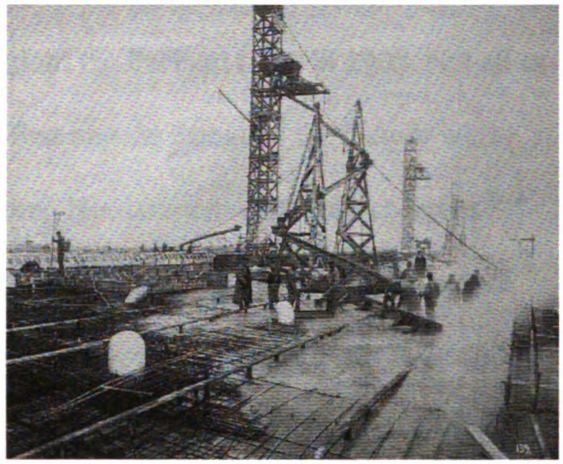

**Figure 4.4 Construction photo of workers pouring cement over a wire frame, creating a strong, reinforced concrete floor.**

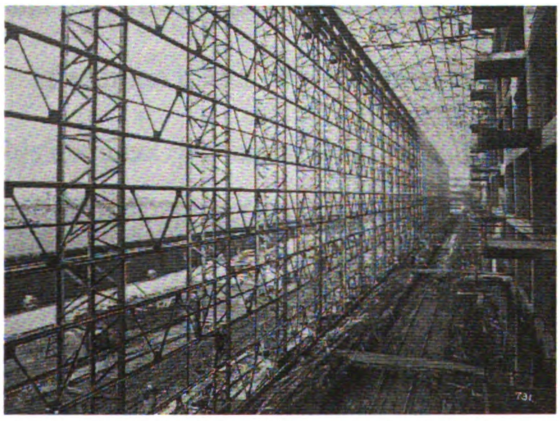

**Figure 4.5 Construction photo of the steel structure of the 1914 extension factory. This steel frame would be covered in concrete and brick.**

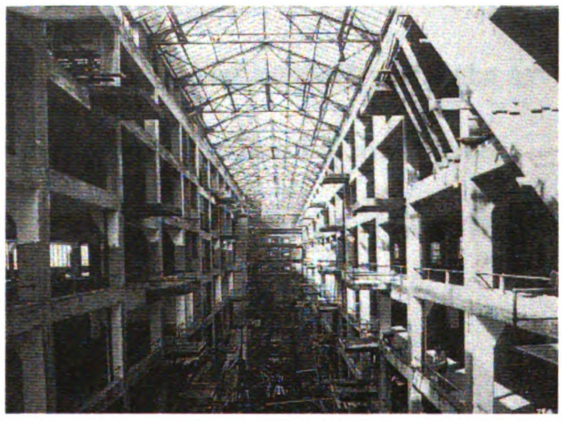

**Figure 4.6 Construction photo of the interior Of the extension factory with reinforced concrete columns.**

[8] Acc. 721, Box 21, Highland Park Repairs, The Benson Ford Research Center, The Henry Ford.
[9] Bucci, *Albert Kahn*, 31.

Julius had started the Trussed Concrete Steel Company, which would later become Truscon Steel Company. The two Kahn brothers along with Ernest Wilby, would work together to produce buildings, using the new technique[10]. The reinforced concrete, or "Kahn system," produced a much more rigid structure and needed less support, which in turn, opened up floor space. It was also fire resistant, a common and serious concern in industrial buildings. Julius and Albert's first collaboration was the building of the Engineering Building at the University of Michigan, Ann Arbor in 1903.[11] Then, came the commission which would draw Ford's attention- the Packard Plant in 1905. Not all of the Packard plant used the new technique. The first nine buildings of the factory were constructed using traditional methods, but building No. 10 used reinforced concrete.[12] The newly formed Albert Kahn Inc. would go on to build several other projects before beginning Highland Park in 1909; the Pierce Great Arrow Automobile Plant in Buffalo in 1906, the Burroughs Adding Machine Company in Detroit in 1907, Chalmer's Motor Car Company in Detroit in 1907, the Mergenthaler Linotype Company in Brooklyn in 1907, and the Brown Lipe Chapin Company in Syracuse in 1907-1909.[13]

In addition to this new building technique, Ford had another reason to choose Kahn as his architect- a compatible outlook. Kahn was often quoted as saying that architecture was 90% business and 10% art. He built his buildings to be based on functionality rather than just aesthetics, reminiscent of Ford's design of the Model T.

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[10] Ibid., 32-33.
[11] Bucci, *Albert Kahn*, 33.
[12] Ibid.
[13] Ibid., 37.

The first encounter between Albert Kahn and Henry Ford came by means of a phone call in 1907 (Figure 4.7).[14] Historian David L. Lewis describes this first encounter in his article *Ford and Kahn*. Ford asked Kahn "Can you build factories?" Kahn's reply, "I can build anything". "Well come over here." said Ford, "I want to talk to you about that new building we are planning..." Larry Raymond, director of architectural development and archivist for Albert Kahn Inc. stated that Ford took Kahn to his site on Woodward, which was then a horse farm and race track. "I went over", Kahn later recalled to a friend, "It was the first time I had ever met Mr. Ford. Mr. James Couzens (Ford's business manager) was with him. Apparently they had been in an argument." Ford said, "Couzens... Has had an architect design our new factory. I don't like it, and they think that the kind of building I want is impossible. I want the whole thing under one roof. If you can design it the way I want it, say so and do it." Albert Kahn later told a friend,

**Figure 4.7 Photo of Henry Ford (right) and Albert Kahn (left).**

> I didn't think it was possible, but I didn't want to tell him that. I wanted to see what could be done. Ford was no help. He could not explain just what he wanted. But when I showed him the first rough drawings, he said "You've got only part of the idea. Now if we can do this, and then do that..." That's the way he has always been. I was not finished with that first design before I realized the magnitude of his conception. And yet even after I had finished I still had a blind spot. I

[14] Vertical File, Albert Kahn, "Michigan History", The Benson Ford Research Center, The Henry Ford.

> suggested to him that he had vast acreage behind his plant, and urged him not to build the front of his factory so close to Woodward Avenue. Why not center it? I asked. He looked at me and laughed. "You still haven't got the most important part of the scheme." he said. "That vacant space is for expansion. By this system we can add on units, link by link." All I ever did (said Kahn), was to take his instinctive hunch and reduce it to a working formula.[15]

On April 30, 1908 the Ford Motor Company board approved the building of Highland Park. The general contractor was B.M. Zadek Company of Chicago, Illinois. The first contract was drawn up on Aug. 3, 1908 with a net contract price of $180,714.00. By the end of construction, largely due to construction difficulties, the final cost of the first building was $250,000.00. [16] Kahn was helped in the development of the plan for Highland Park by Ford engineer Edward Crey.[17] Kahn would go on to build more than a thousand structures for Ford Motor Company at various locations. But his work did not stop there. Among industrial jobs, Kahn built 150 General Motors plants, dozens of Chrysler facilities, and hundreds of other industrial facilities both in the U.S. and abroad. By the mid-1930's Alfred Kahn Inc. handled 19% of America's industrial buildings. By the end of his career, he had designed more than two billion dollars worth of buildings, most of which were for industry.[18]

The effect of working on industrial buildings, so many of which were done for the Ford Motor Company, was not just one-sided. For as much as Kahn was able to influence industrial architecture, his relationship with Henry Ford would come to influence his own

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[15] David L. Lewis, "Ford and Kahn" Michigan History, (September/October 1980): 17-32. Albert Kahn Vertical File, Benson Ford Research Center, The Henry Ford.
[16] Edward S. Patterson, "The Highland Park Plant" unpublished manuscript, (January 6, 1954). Albert Kahn Vertical File, Benson Ford Research Center, The Henry Ford.
[17] Brinkley, *Wheels for the World,* 137.
[18] Lewis, "Ford and Kahn" 18.

firm. As early as 1905, Kahn began using the ideas of scientific management in his firm. This should come as no surprise when one considers the scope of what was being built. Industrial buildings were unbelievably complex and as such many different aspects had to be taken into consideration in their design. Kahn did not work alone, but rather formed a team of associates to design his projects, including Highland Park. This concept was to expand beyond his firm. Kahn stated, "The architect qualified to handle the problems of today must be a combination of many parts, and as I recently read, must, like the conductor of a well organized orchestra, assume leadership in directing groups of men to produce concerted and harmonious results."[19]

Kahn also emphasizes the role of the engineer. "The modern industrial building, as well, owes much of its success to the engineer, for to him is assigned the task of providing the network of mechanical veins and arteries of a modern structure nearly as complex as the human body".[20] Lastly, Kahn noted the importance of the relationship between the architect and the client. He cited the necessity of knowledge in the areas of, "building laws and restrictions, land values, the possible return of contemplated investments, the best methods of financing projects-in short, they [clients] like to confer with architects much as they would with their bankers".

And he conceded that the architect had to practice, "sincerity, honest frankness, open-mindedness, common sense and aptitude to grasp requirements, directness and willingness to consider and accept the owner's point of view".[21]

Historian Federico Bucci summarized the organization of Kahn's firm,

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[19] Bucci, *Albert Kahn*, 125.
[20] Ibid., 126.
[21] Ibid.

> In order to establish a correct relationship with the various tasks, the architect- or better, a group of designers- had to be prepared to furnish detailed designs and instructions (to avoid delays and misunderstandings), pay attention to costs, insurance and payroll, oversee the phases of the construction, and provide inspection and assistance on the worksite.[22]

In all, Kahn's team would include designers, urban planners, and civil and mechanical engineers. It would take a group of highly trained and knowledgeable men to produce Highland Park, but the similarities in how Ford ran his company and how Kahn ran his firm are quite interesting.[23] The two men no doubt had an effect on each other. Kahn would go on to design some of the most innovative and beautiful buildings of his time. For as much as Ford would affect the automotive industry, Kahn would affect just as much in architecture.

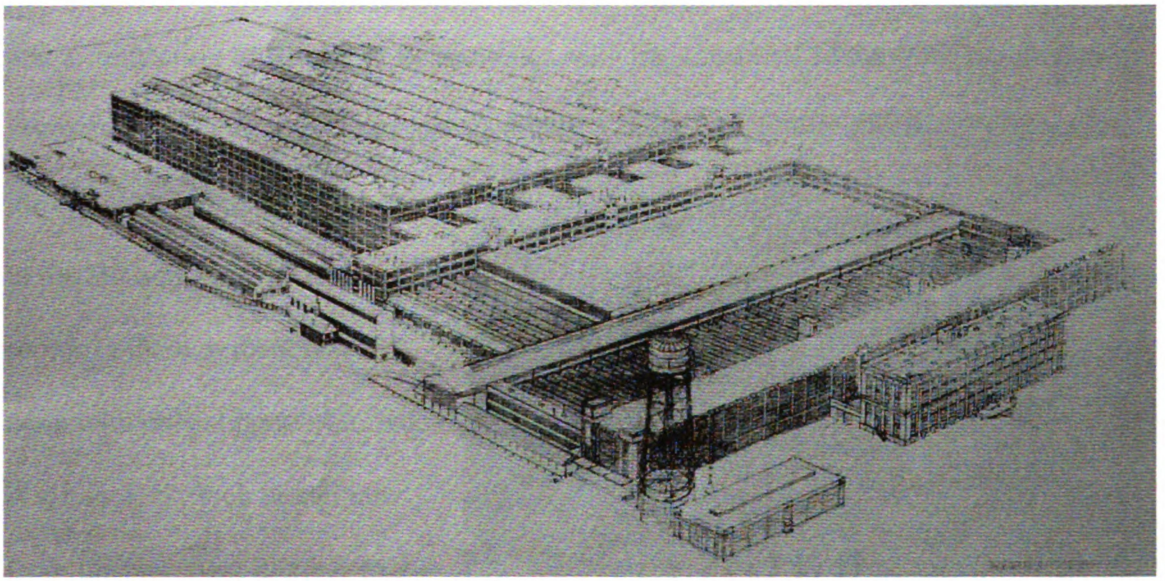

**Figure 4.8 A 1910 Drawing of the intended extension of Highland Park factory complex. Construction of the six story factory buildings pictured in the rear of the complex was begun in 1914. Note the administration building and the original power house in the foreground.**

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[22] Ibid.

[23] For more information on Albert Kahn's company organization see Grant Hildebrand, *The Architecture of Albert Kahn* (Cambridge: The MIT Press, 1974): 126-128.

*The Administration Building*

The most decorative of the early buildings at Highland Park was Job 375D.[24] This was to be the administration building built in 1909-1910. It was the highlight of the factory complex, situated dead center on Woodward Avenue, right up to the sidewalk. This building was beautifully decorated both inside and out. The building used a variety of materials, such as tile, wood, stone, marble, Hy-rib (a type of decorative wood paneling), and brick. The original building stood two stories tall, and included a basement. At the center of the building's basement was a set of rooms that consisted of a women's toilet, store room, and men's smoking room. Across from this, was another set of rooms that consisted of a women's locker room with eight center sinks and a connecting toilet room. Just in front of this toilet room lay a massive marble staircase, and to its right, the men's locker room which was nearly twice as large as the women's. It included ten center sinks and a connecting toilet. All of these rooms, with the exception of the store room, were decorated with a terrazzo floor and tiled walls. These rooms were electrically lit, as was the entire structure. The vast area to the left and right of these rooms in the basement was left open with only support columns. A six foot, six inch tunnel ran from the basement directly to the power building. The tunnel also connected to a small hose and

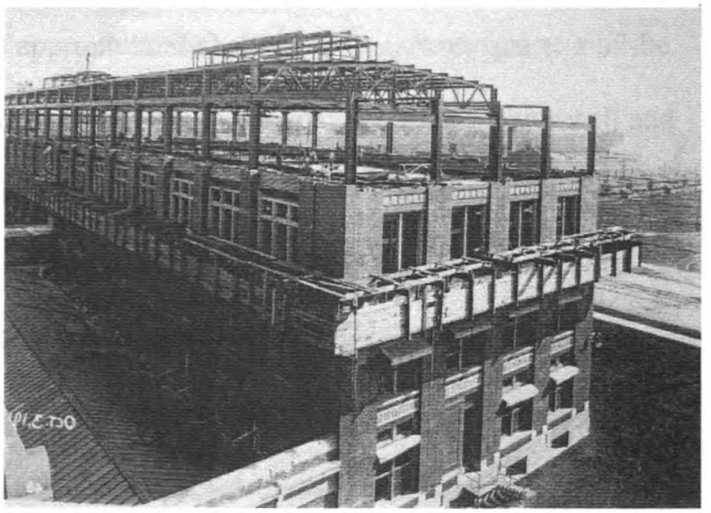


**Figure 4.9 Photo of the construction of the 1913 addition added to the Administration Building. The original two stories were kept, and another two stories were added to the top.**

[24] Job #375D 1909-1910, Drawer 2 Folder 2, The Bentley Historical Library, University of Michigan Ann Arbor.

hydrant house that sat next to the power building. The entire administration building was supported by eight main support columns along the outside walls and a line of sixteen equally-spaced columns down the center of the building.

The main floor of the administration building must have been quite a sight. The front door opened into a large, open lobby with a terrazzo floor. Across from the entrance, along the back wall, was a massive marble staircase with a decorative iron railing. The walls of the entrance hall had a marble base and the rest of the wall was covered in large, flat blocks of stone. The walls were broken up by a series of flat stone pilasters (columns) with decorative leaf-design capitals. The entrance was also vaulted, allowing the visitor to see into the second story. The support columns in the entrance hall were covered with grooved wood boards.

A series of six rooms of varying size lay around the entrance hall along the front and back of the building. These rooms had hard wood floors and sash doors with terrazzo thresholds. The walls along the hall and in the offices consisted of grooved wainscoting (wood paneling) at either a height of approximately half the wall or three quarters of the wall. A decorative wood molding separated the paneling from the plaster upper wall and a thick, picture molding ran along the top of the wall, a foot or so below the ceiling line. A wide terrazzo-floored hall ran down the center of the building, between the rooms.

To the left of the staircase was a women's toilet with two sinks and three stalls. The men's toilet, to the right of the staircase was slightly larger with three sinks, two urinals and three stalls. The interior of the bathrooms were luxuriously decorated. The stalls in both had marble partitions. The stall doors consisted of four square wood panels mounted in marble. The walls were covered in tile with marble accents and the floors were

finished in terrazzo. An elevator with a decorative wire screened door lay to the left of the women's toilet. The ends of the building on the ground floor were left open, creating large open spaces at either end with hardwood floors.

The second story consisted mostly of office space, but was still very decorative. The offices ran along the front and rear of the building with a central hall covered in a rubber tile floor (an interesting innovation in itself). The offices had sash doors, and those that lay along the main central hall had marble thresholds. Again a women's and men's toilet lay on either side of the marble staircase, decorated in a similar fashion to those downstairs. Throughout the building were highly decorative ceilings, which were broken into large squares. Each square was lined with thick floral moldings, the center of which was decorated in a pattern resembling fish scales.

The exterior of the building included decorative elements as well, which blended with the other buildings at the site. The base of the building was made of large stone blocks. Above these blocks, rose large brick columns equally spaced along the length of the building, with windows in between, giving it the illusion of a larger height. The space below each window was divided into two parts. The upper space had a decorative iron grill. Below this, was a flat metal panel lined with rivets. Above each set of windows on the ends of the building were a series of decorative tiles. The cornice (roofline) was decorated with diamond-shaped tiles along the entire length of the building. This original administration building would be expanded in 1913, adding an additional two stories to the structure (Figure 4.9).[1] The exterior of the addition was styled identically to the lower two levels, with only several changes. The columns that ran along the front facade were

[1] Acc. 1660, Box 130, Highland park Construction, 08485, The Benson Ford Research Center, The Henry Ford.

recoated with cement, making them much more pronounced from the building. A horizontal line, the exact width of the columns and also made of cement, ran between the original two lower floors and the new third and fourth floors, visually dividing the building in half (Figure 4.10).[2]

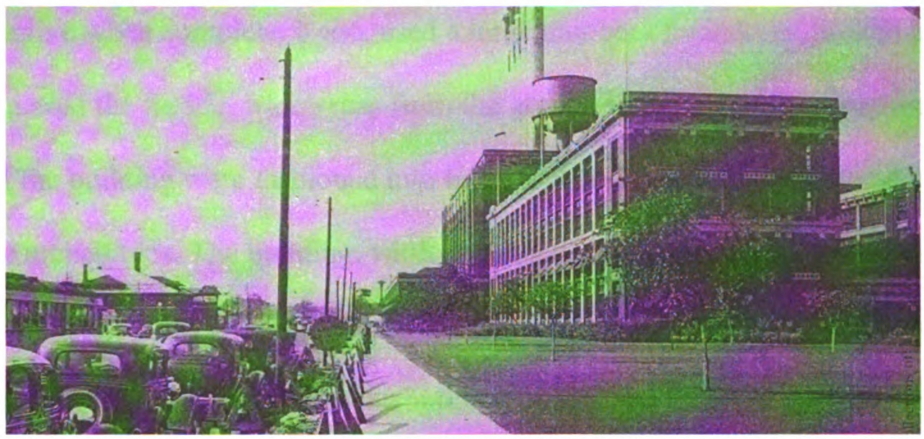


**Figure 4.10 Photo of the finished, four story Administration Building taken in 1937. This building, along with the power house next to it would be demolished in 1959.**

By 1912 the factory complex had expanded, and would consist of an administration building, power building, foundry, heat-treating plant, forge, machine tool room, machine shop, radiator department, painting and varnishing department, assembling department, testing room, shipping department and experimental laboratory, all of which had their own unique structures, designed by Albert Kahn Inc.[3]

*Powering Highland Park*

Job 375 A, the plant's first power building dated 1909, was one of the first expansions at Highland Park.[4] This building was another combination by Kahn of functionality and

[2] Acc. 721, Box 22, Highland Park construction 1937-1940, 68658, The Benson Ford Research Center, The Henry Ford.
[3] Ford Facts, 1912-1959, Vertical Files, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.
[4] Job #375A 1909, Drawer 2 Folder 1, The Bentley Historical Library, University of Michigan Ann Arbor.

aesthetics. The power house however, leaned more heavily towards aesthetics than did the factory building. Ford placed his power house directly on Woodward Avenue, in full view for the public to see. This was not common practice. Most factories of the time hid their power houses in the rear of their complex, out of public sight. The building was quite attractive when complete. It too, used a large number of windows, broken into three divisions across the facade, which rose from the ground to the top of the structure. The corners of the building were fashioned into brick towers (similar to the factory) with decorative arched tops. The building, while much more decorative, was still similar in design to the factory and provided plenty of common characteristics to complement the factory's appearance. The interior of the building housed the factory's engines. The copper sleeves of the vents were routed through the walls and encased in brick, which opened up the interior of the building and no doubt helped to keep the temperatures down. The wire-domed tops of the vents protruded from the top of the roof, giving the building its characteristic look.

**Figure 4.11 Photo showing the construction of the foundation of the new power house in 1916. In the background is the construction of the new AA extension building.**

This original power house, while innovative for its time, was soon to become unable to provide sufficient power for the expanding factory complex. The decision to redesign it

was made, and construction of the new structure began in 1915 (Figure 4.11).[5] The new power house would also be positioned directly on Woodward Avenue, rebuilt out of the original structure. The original was completely demolished and rebuilt. This new power house would become an icon and a metaphor for the Ford Motor Company's success. The power house would cover 20,000 square feet. Its five smokestacks stood 275 feet tall, reaching 155 feet above the top of the building. In the space between each of the stacks, the company mounted a letter of the Ford name, making the whole structure into one of the world's most impressive billboards (Figure 4.12).[6] When completed in 1916, it was the largest isolated building of its kind in

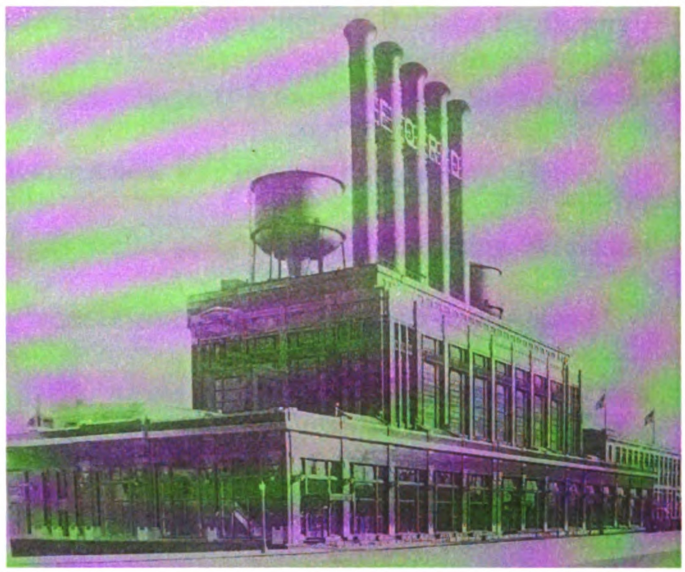


**Figure 4.12 Photo of the new power house taken in 19 20.**

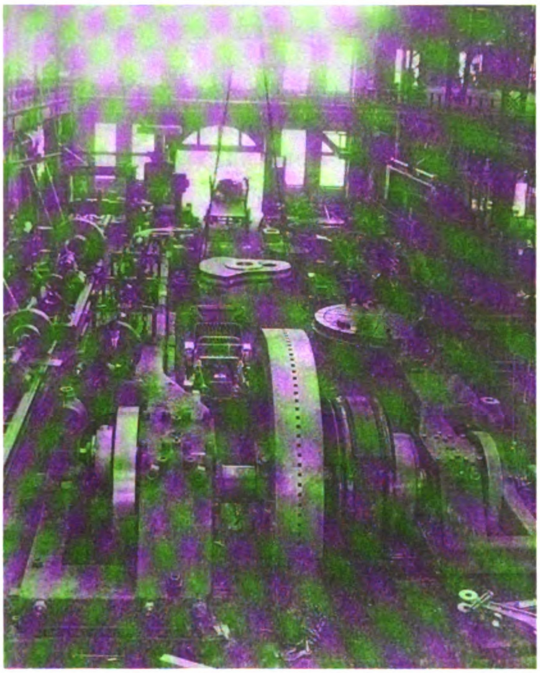


**Figure 4.13 Photo of the installation of the new power house's gas-steam engines. Note the Model T sitting behind the engine, highlighting the massive size of the engine, which extended a story below the floor.**

[5] Acc. 721, Box 21, Highland Park construction 11916-1917, The Benson Ford Research Center, The Henry Ford.

[6] Acc. 1660, Box 131, Highland Park Power Plant, 833-2916, The Benson Ford Research Center, The Henry Ford.

the world.[7]

The new structure housed first four, then nine gas- steam engines. Because the factory complex was located far from a natural water source, (the most common form of power for early factories), engineers had to devise a new way to power the factory. The original power house used a producer-gas engine designed by Edward Grey. While gas engines provided high efficiency, they were often unreliable. The new power house would use a composite gas-steam unit first designed by W.B. Mayo, in which a gas engine was combined, side-by-side with a steam engine. This gave the efficiency of gas and the reliability of steam. The building's nine gas steam engines, along with its one straight 1500 hp steam engine, could produce a total of 54,500 hp (Figure 4.13).[8] Ford was so proud of his new power system he would even show the engines off to the public.

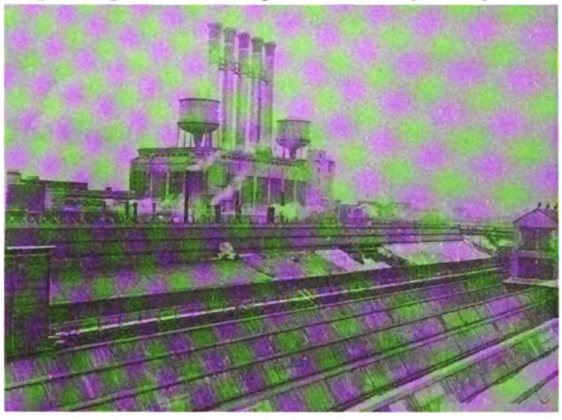


**Figure 4.14 Photo of the rear of power house taken from over the machine shop in 1942.**

The interior of the new power house would become a showcase to the modern era. It contained an observation balcony overlooking the engines for the visiting public. The massive engines were even

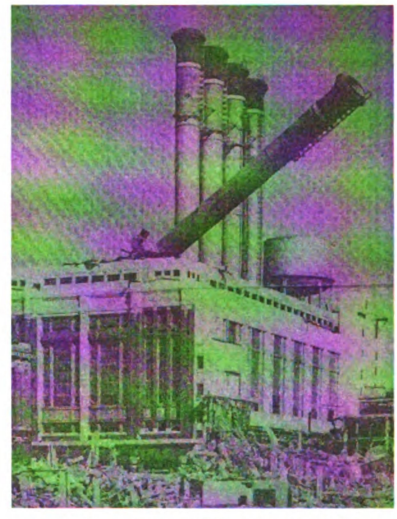


**Figure 4.15 Photo of the demolition of the power house in 1959.**

[7] "Famous Highland Park Stacks Topple as Plant Modernization Continues" Ford Rouge News, 14 (August 7, 1959), Vertical File, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.

[8] Thomas Wilson, "The Ford Gas-Steam Plant" Power, 44 (November 21, 1916): 706-710, Vertical File, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.

surrounded by an intricately patterned tile floor. These engines were not simply for use, but rather an industrial work of art (Figure 4.14).[9]

Unfortunately, the power house cannot be seen today (Figure 4.15).[10] It was demolished on July 25-26, 1959 as 200 Highland Park residents watched.[11] One of its original two and a half story gas-steam engines was saved however, and can be seen at The Henry Ford Museum. The power house's former site is now covered by a strip mall and parking lot.

*The Giants of Manchester*

By 1914 the second major phase of the factory's construction had begun. This was the series of six-story buildings along Manchester Avenue. The concept was the open-purpose building, which followed the original factory's system in which production progressed from top to bottom. Its intended use was to produce the parts of the Model T's body. The building's most impressive innovation was its craneway. The factory portion of the structure was constructed around a railed, traveling crane that ran through the six-story open center of the building (Figure 4.16).[12] Seventeen balconies along each level on

**Figure 4.16 Photo of the interior craneway of the six story extension building, just prior to completion.**

[9] Acc 721, Box 21, Highland Park Repairs, 45, The Benson Ford Research Center, The Henry Ford.
[10] Vertical File, Highland Park, "Ford Rouge News", The Benson Ford Research Center, The Henry Ford.
[11] "Famous Highland Park Stacks,".
[12] Acc. 721, Box 21, Highland Park Repairs 1913-1914, 794, The Benson Ford Research Center, The Henry

either side of the open center were used as loading docks. The structure's exterior windows were 75% double strength glass in a steel sash. The ceiling over two of the four building's craneways were nearly entirely made of ribbed wire glass, enabling a tremendous amount of natural light to enter the structure.

It was a very bare structure, but housed closely packed machines intended to save lifting and time. Conduits were used to bring tools and materials along the line at exact times. Inspectors were also positioned along the lines, and paths were left for managerial surveillance.[13]

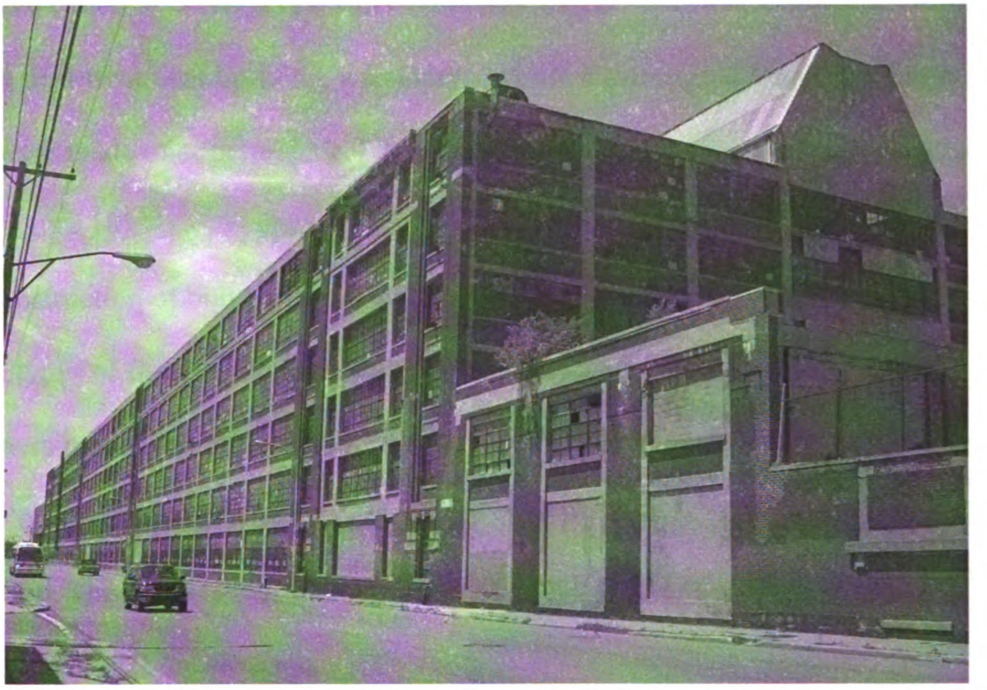


**Figure 4.17 Current photo of the six story extension building on Manchester Avenue. Taken by AKJ, June of 2008.**

Ford.

[13] Carter, ed., *Albert Kahn Inspiration,* 35-36. This article includes a description of the factory's operational systems. The actual operational systems of the factory mentioned in the article did not involve Albert Kahn.

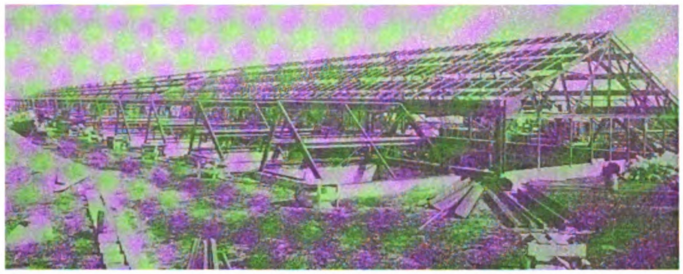


**Figure 4.18 Photo of the structural steel construction of the Forge taken in 1914.**

Arnold and Faurote's *Ford Methods and the Ford Shops,*[14] gives a detailed account of the Highland Park complex and details of construction in 1915. Prior to the completion of the new six-story building, there were already three buildings standing four stories high,which covered 28.29 acres of floor space in 1915. The administration building alone covered 2.12 acres. All multiple storied buildings were made using reinforced concrete. Several one story buildings also existed, which housed machine shops, a heat-treatment building, a foundry, an auto shed, engine house and boiler house. These were made of structural steel with concrete foundations and brick or concrete side walls (Figure 18).[15]

The construction of buildings and materials used at the factory complex varied greatly. Several types of floors were used based on the operations being housed. Machine shop floors were made of timber placed over tar rock or cinders on a six inch concrete foundation. The wood provided an absorbent material for the large quantities of oil thrown while machining. This helped to keep the workers from walking over excessively

**Figure 4.19 Photo of the motor testing area taken in 1912. Note the wood flooring.**

[14] Horace Lucien Arnold and Fay Leone Faurote, *Ford Methods and the Ford Shops* (New York: Elibron Classics, 2005): 23-30.

[15] Acc. 721, Box 21, Highland Park Repairs 1913-1914, 565, The Benson Ford Research Center, The Henry Ford.

slippery surfaces.

Wood also helps to dampen the vibration of large machines in operation. In some areas the wood flooring was placed on edge, with the grain facing up. This technique made the floor denser and much stronger. It also allowed the oil from the machines to easily slip through the boards, rather than collecting on the surface (Figure 4.19).[16] Occasionally, the company would come through and grind a very thin layer off of the top of the boards to clean it.[17]

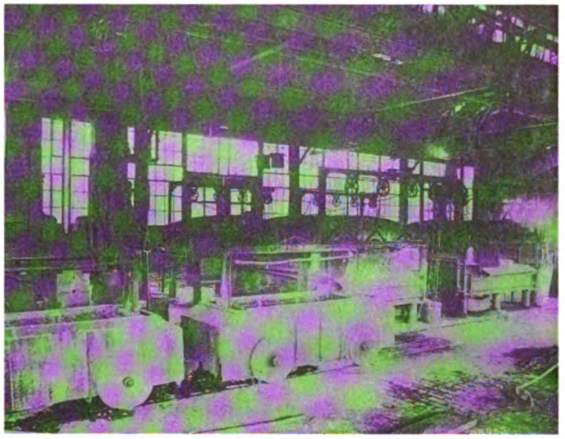


**Figure 4.20 Photo of the brick flooring used in the heat-treatment building.**

Each building used the type of flooring best suited to its operations. The heat-treatment building used a brick floor with concrete patches underneath the machinery, to keep the heavy machines used in the building from settling unevenly (Figure 4.20).[18] The brick used could better handle the heat of the treatment process without cracking.

The foundry used a dirt floor with patches of brick and concrete (Figure 4.21).[19] The dirt could withstand the high temperatures of newly formed castings which could damage other surfaces, as

**Figure 4.21 Photo of the interior of the foundry. Note the dirt floor and piles of casting sand.**

[16] Acc. 1660, Box 131, Highland Park Interiors, 0-8407, The Benson Ford Research Center, The Henry Ford.

[17] This description came from my dad, who worked as a machine repairman for the Ford Motor Company. In the early part of his career, he worked in many of the original buildings of the Rouge, even working on some of the original belt driven machines that had been retrofitted with electric engines.

[18] Acc. 1660, Box 131, Highland Park Interiors, 0-8397, The Benson Ford Research Center, The Henry Ford.

[19] Acc. 721, Box 21, Highland Park Repairs 1913-1914, 211, The Benson Ford Research Center, The Henry Ford.

well as quickly absorbing the casting's excess heat. Most of the rest of the factory used concrete flooring, although the upper three stories of the original factory used one-inch thick maple over cinders.

Roofs were made of reinforced concrete, covered with built-up roofing.[20] They were typically flat, with the exception of the machine shop and foundry which were saw-toothed, allowing light to enter from the ceiling, and providing ventilation (Figure 22).[21]

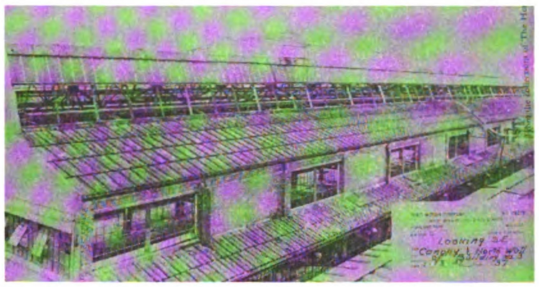


**Figure 4.22 Photo of the saw toothed roofs of the machine shop.**

While systems of conveyors, hoists, and other methods of moving materials existed throughout the factory, the company still had a workforce of 800 to 1000 men in 1915 that were used as truck-men, pullers, and shovers. At its lightest, a Model T weighed 1,400 pounds. At a production rate of 100 a day in 1915, these men and their mechanical counterparts moved approximately 1,400,000 pounds a day. This type of work, much like the buildings themselves, was evolving and the new craneway being built would eventually eliminate these

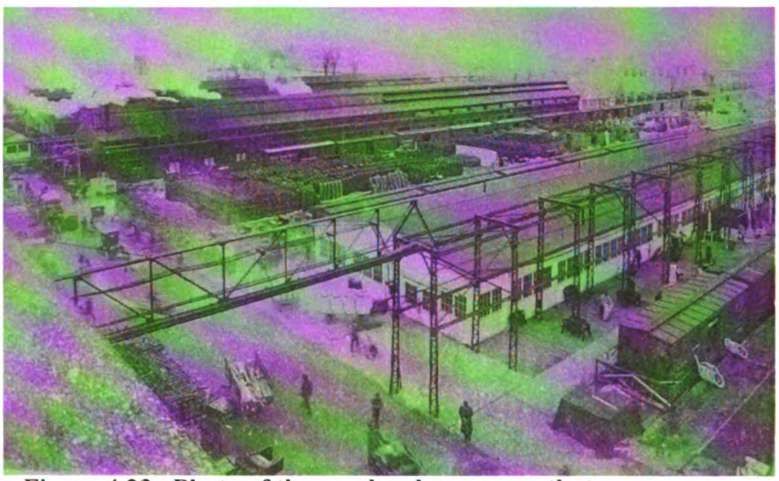


**Figure 4.23 Photo of the overhead craneway that ran throughout the Highland Park complex.**

[20] Built-up roofing is a technique in which layers of tar paper are placed over the wood roofing planks. The paper is then coated with hot tar and covered in gravel. These roofs are typically flat and the technique is still the most commonly used one for large buildings today.

[21] Acc. 721, Box 21, Highland Park Repairs 1940-1948, 87, The Benson Ford Research Center, The Henry Ford.

jobs (Figure 4.23).[22]

As of February 10, 1914, the cost of buildings, tanks and fixtures was $3,575,000. 00. Machine tool equipment totaled as $2,800,000.00.[23] Construction of the factory complex had taken 12,124 tons of structural steel, 10 million bricks, 172,000 barrels of Portland cement, and 471,185 square feet of glass. The existing power plant now had to burn 40 tons of coal per hour, producing 2.2 million cubic feet of gas daily- enough to power a city of 100,000 people a day. The machine shop, covering ten acres, housed 5,500 machines, 1,000 drill presses, 700 turning lathes, and 300 punch presses. Some of these machines weighed up to 50 tons each.[24]

In total, by 1915 the complex consisted of 56 acres, 47.5 of which were under one roof. It now housed a hospital unit, assembly departments including a final assembly, receiving department, body department, upholstering, tops and curtains, punch presses, fire protection equipment, as well as the Ford English school, for its many newly immigrated employees, a

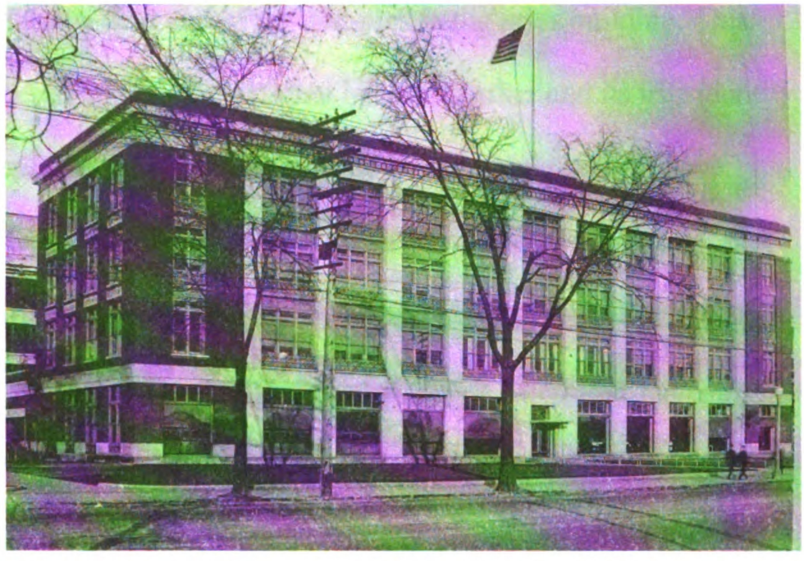


**Figure 4.24 Exterior photo of the Highland Park Sales Building, Courtesy of Albert Kahn Inc.**

[22] Acc. 1660, Box 131, Highland Park Exteriors, P833-146, The Benson Ford Research Center, The Henry Ford.
[23] Arnold and Faurote, *Ford Methods*, 23-26.
[24] Wilson, "Giant of Industry".

factory service office and a photographic department which employed 20 workers[25] and was capable making of motion pictures.[26]

The factory produced 300,000 cars in 1915, using 125,500 tons of steel, 1.725 million square feet of plate glass, 15 million square feet of upholstery, and 34.6 million square feet of rubber for model T tops. Ford now employed 18,028 hourly workers, representing 49 different nationalities.[27]

*The Sales Building*

Of the three main buildings Ford Motor Company placed directly on Woodward Avenue only one has survived. Both the large administration building on the south-east end near Manchester Avenue and the power house that stood next to it were torn down. The one building left, on the north-west end of the complex is the sales building. This particular building stands directly behind the national historic marker and its true identity is often mistaken. Many people, including those working in historical archives have believed it to be everything from the original factory to an administration building. The only source of its true identification available was the building's original blueprints and several original photographs of the structure kept on file at Albert Kahn Inc. The blueprints label the building as the Ford Sales Building, Job #375BE.[28] They also date the building's conception on May 23, 1919, and a revisal date of May 31, 1919. This structure was the

[25] Carter, ed., *Albert Kahn Inspiration,* 45.
[26] Ford Facts, 1912-1959, Vertical Files, Highland Park, Folder 1 of 2, The Benson Ford Research Center, The Henry Ford.
[27] Wilson, "Giant of Industry".
[28] Job #375BE 1919, Albert Kahn and Associates.

showroom for Ford's creations and as such served as an ambassador to the public for the Ford Motor Company.

No expense was spared. The building stood three stories tall, sixty-two feet wide and two-hundred feet long. The sales building even included a garage, which was sandwiched behind the sales building and the factory extension building (labeled AA on the blueprint) behind it. The garage was quite simple, forty-five feet wide and just under two-hundred feet long, with the exception that the entire area was covered without the use of any interior support columns (Figures 4.25 and 4.26).[29] The roof was nearly entirely made of

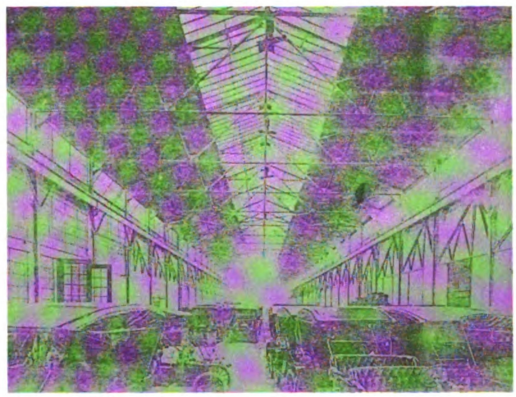


**Figure 4.25 Interior photo of one of Highland Park's auto storage sheds complete with Model T's.**

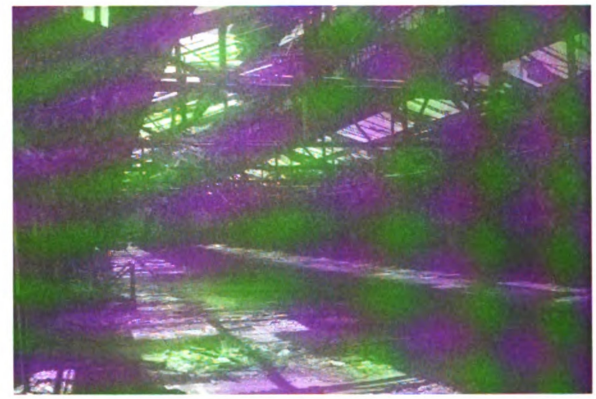


**Figure 4.26 Current photo of the auto garage behind the sales building. Taken by AKJ, June of 2008.**

wire-mesh glass, allowing a tremendous amount of light in. Large cargo doors for entry and exit, were set on either end of the garage. Inside were a series of cement curbs around the perimeter walls. In the back left corner was a cement floored wash stall. This no doubt was used to clean a car up just before the new owner picked it up, a common practice still

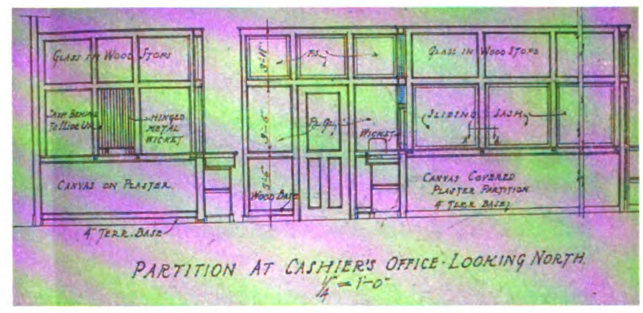



**Figure 4.27 Detail of the parts replacement office in the sales building. Courtesy of Albert Kahn Inc.**

[29] Figure 25- Vertical File, Highland Park Auto Storage Areas, B88831, The Benson Ford Research Center, The Henry Ford.

done in modern car lots.

While the garage was purely functional in its aesthetics, the first floor of the sales building was far from it. The north-west end of the building held a large storage room, connected to which, was a rectangular parts replacement department with terrazzo floors. This room connected to the storage room with a wall of sliding sash windows and a cement counter. Parts could be handed through the open windows or, if necessary as in the case of larger parts, brought through an accompanying side entrance door. Directly in front of the replacement department was a cashier's office which connected to the replacement department by a hinged metal wicket. A second wicket, on the right of a door connecting the cashier's office to the stockroom, was left open. The customer could come into the

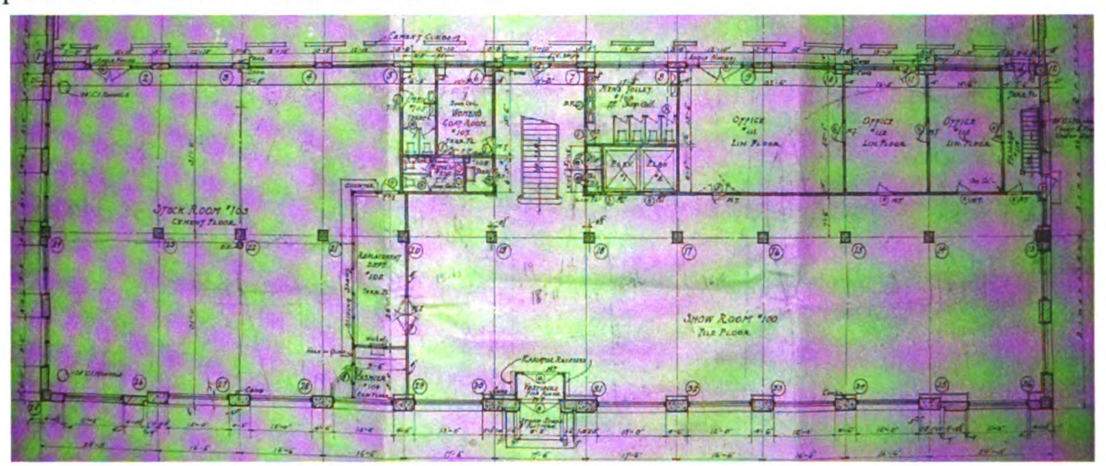



**Figure 4.28 Detail of the floor plan for the first story of the sales building. Courtesy of Albert Kahn Inc.**

replacement office, buy their part and pay directly at the cashier's office without having to move more than several steps (Figure 4.27). What is interesting is the fact that this layout is nearly identical to many car sales repair departments today, although modern examples are far less decorative, lacking

large open windows, terrazzo floors and wood paneling. Short of three large offices along the back wall, the rest of the first floor was dedicated to Ford's customers. The customer would walk up to the building along an elegant herringbone designed brick walkway, styled to match the brickwork of the original factory (Figure 4.29). Stone steps led up to a tile floored vestibule and two glass doors se brass led into the showroom. A flat brass overhang was set

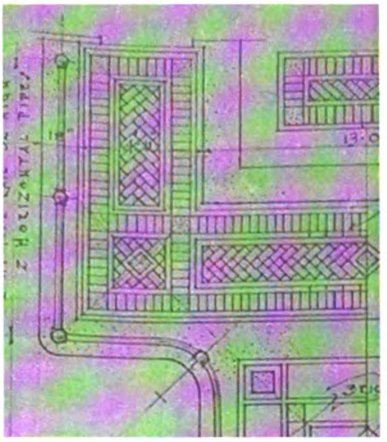


**Figure 4.29 Detail of the front walkway. Courtesy of Albert Kahn Inc.**

**Figure 4.30 Interior of the sales building. Courtesy of Albert Kahn Inc.**

directly above the door, identical to the one on the administration building. When the customer walked through the doors, they were met with a spacious showroom. Directly across from the entrance was a marble grand staircase with decorative iron railings that fanned out like an open bloom as it reached the showroom floor (Figure 4. 30). To the left of the staircase, tucked neatly behind a wood paneled wall were a women's toilet room with two stalls and an adjoining coat room. These rooms all had terrazzo floors. To the left of the women's

toilet was the men's toilet, which could be accessed only from the store room and certainly intended for employee use only. Directly in front of the toilet was a janitor's closet and on the corner connecting to the showroom, was a men's smoking room. To the right of the staircase was another men's toilet room intended for customer use. It housed three stalls, two urinals and four sinks. Directly in front of it and connecting to the showroom was a set of two personnel elevators and two telephone booths. To the right, running along the back wall, were three large offices with linoleum floors. The rest of the first floor was open showroom with a tile floor. The entire building was held up by thirty-six support columns. Those which were in the showroom were covered in marble and had an intricate carved swan design on their capitals. The walls of the showroom were covered in carved wood paneling on the lower half and plaster along the top half. The front of the showroom, facing Woodward Avenue was nearly all windows. These windows were quite unique; they were just larger than the width of a car and opened like garage doors, allowing vehicles to be brought in and out of the showroom. The showroom also had a cavernous, high ceiling. The ceiling was recessed and decoratively molded in a large octagon pattern with smaller square recesses in between. Large chandeliers hung from the ceiling and sets of massive curtains spanned from the floor all the way up to the ceiling, emphasizing the height of the room. Massive oriental rugs were also laid out leading from the front door to the staircase and another to the replacement department.

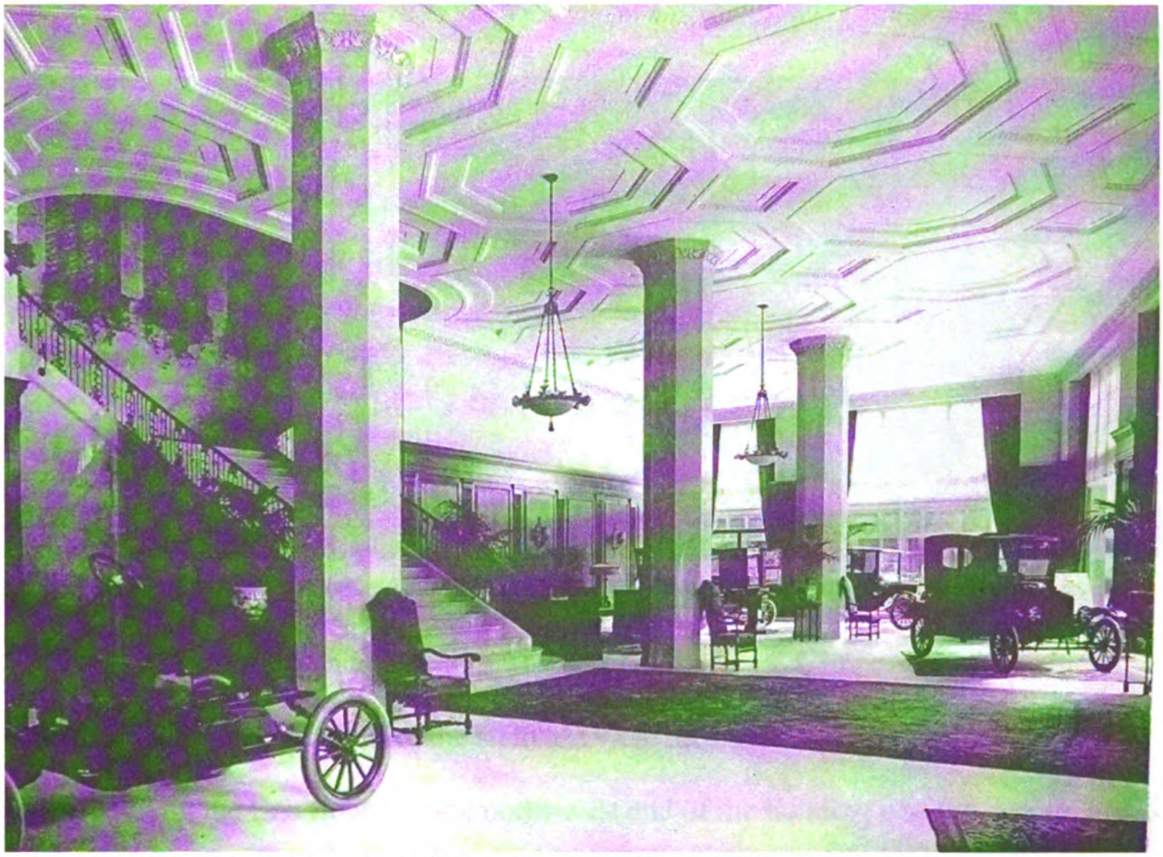


**Figure 4.31 Interior of the sales building. Courtesy of Albert Kahn Inc.**

One can only wonder how much of the original decor is still left among the carts of documents which currently take up the building's space. There is also an interesting clue to be found in the original photographs of the showroom (Figure 4.31).[30] A sign sitting behind one Model T notes that these cars were used, not new cars, as one might suspect. Ford not only sold new Model T's at his factory but refurbished used ones as well, making this one of the most extravagant used car lots in the world.

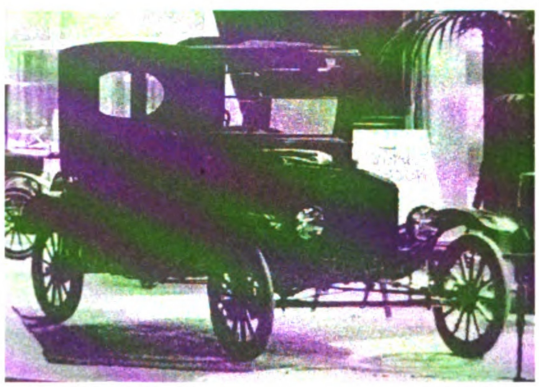


**Figure 4.32 Detail of the above photo. Note the sign setting behind the Model T.**

[30] Highland Park photos courtesy of Albert Kahn and Associates.

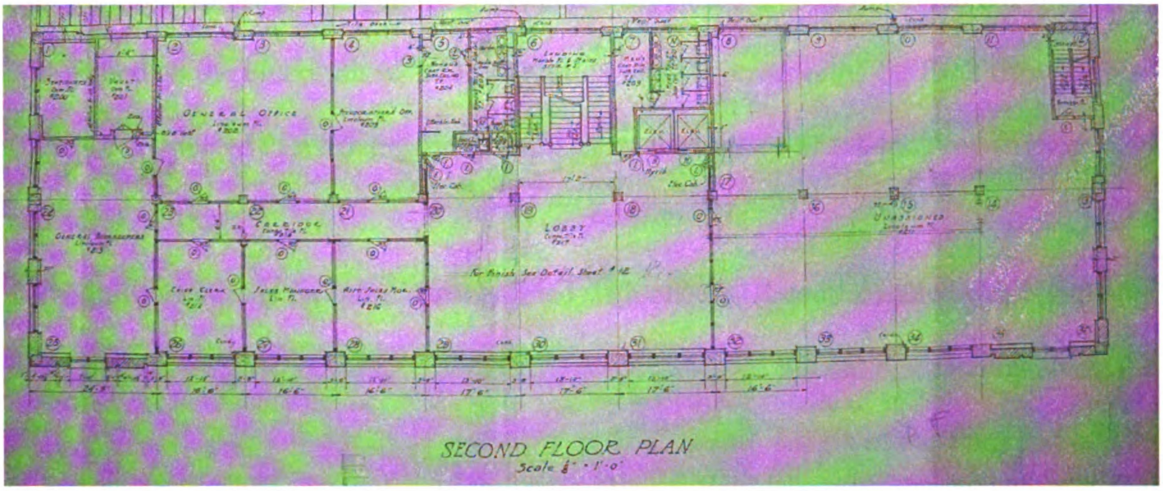



**Figure 4.33 Detail of the second story of the sales building. Courtesy of Albert Kahn Inc.**

The second floor of the sales building was devoted to the more important offices in the building. To the left and right of the staircase were the men's and women's toilets, similar to the setup on the first floor. On the north-west end of the building was the general book-keepers office. Along the rear of this office, on the back wall of the building was a stationary storage office and to its right, the building's vault.

Next to the vault but not connecting to it, was a massive general office connecting to a central hallway by two doors. Between this office and the women's toilet and coatroom was the stenographer's office. Directly across from these, on the opposite side of the hallway, along the front of the building, were the offices of the chief clerk, sales manager and assistant sales manager. A large lobby lay in

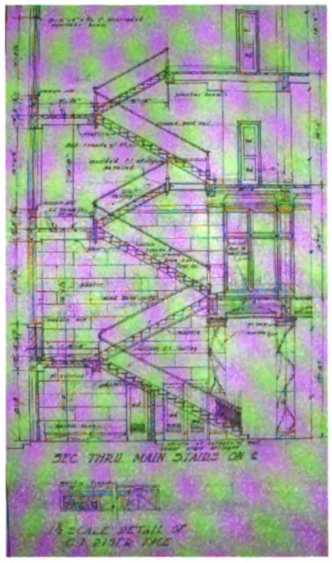


**Figure 4.34 Detail of the rear stairway in the sales building that connected to the fire escape.**

**Figure 4.35 Current photo of the fire escape. Taken by AKJ, June of 2008.**

front of the staircase and the entire south-east wing of the second floor was left unassigned on the blueprint, with the exception of a staircase in the far back corner. This staircase connected to a fire escape that ran along the outside of the building (figures 4.34 and 4.35).

The third story was far more densely lined with offices. A central hallway of composite tile ran horizontally along the length of the floor and offices connected to it, lining the perimeter of the building. Men's and women's toilets, nearly identical to the second floor lay next to the staircase.

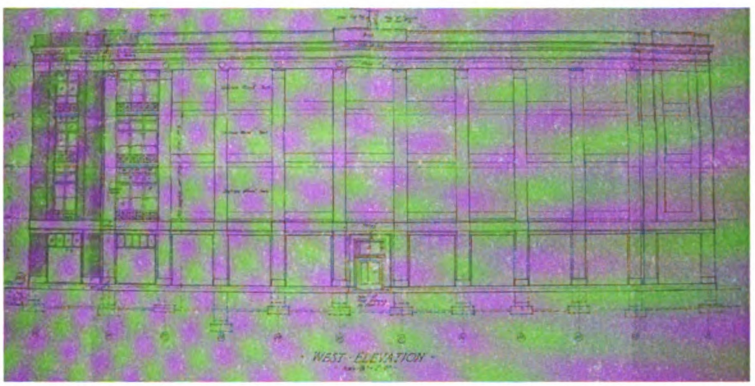
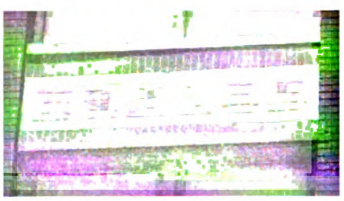



**Figure 4.36 Detail of the sales building facade . Courtesy of Albert Kahn Inc.**

The building had a composition roof with a machine and fan room just off of center, which distributed power throughout the building. A massive flag pole was mounted the building's roof as well, which flew a large American flag.



The exterior of the building is much the same today as it was when it was first built (Figure 4.36). The facade of the building is covered in brick with ten vertical columns of cement between each set of windows. Each column ha a flat cement medallion at the top, above which was a cornice of brightly colored patch-work

**Figure 37 Current photo of the left side of the sales building. Note the decorative tiles above the windows and along the cornice. Taken by AKJ, June of 2008.**

tiles. Between the columns are each story's windows, laid out in sets of three. At the base of each set of upper story windows, was a decorative iron grate, which is gone today. A horizontal cement cornice, with the same proportions as the vertical columns runs along the top of the garage door-style windows on the first floor, giving the building a characteristic look that sat it apart from the administration building. While the building has four stories of windows it actually only houses three floors. This illusion is due to the fact that the first floor is twice the height of a normal floor, giving the building its cavernous showroom.

**Figure 4.38 Photo of the sales building with the Lincoln logo above the door, taken in 1937.**

While the Sales building was undoubtedly beautiful inside and out, it was still dwarfed by the size of its neighbors, the power house and administration building. It is curious why the Ford Motor Company (long after the death of Henry Ford himself) would tear down the other structures and leave this one. However, there are a few clues in the evidence left behind. Photographs show that the building was converted over to Lincoln Sales by August of 1937 (Figure 4.38).[31] It had evolved back into a used car lot, by June of 1940 (Figure 39),[32] but by this time its intricate walkway and front lawn had been ripped out. The space was used to expand the car lot. A small office extension was also

[31] See Acc. 721 Box 22 Highland park Construction and Repairs 1937-1940, folder 4 of 4, photo #68658-5, The Benson Ford Research Center, The Henry Ford.
[32] See Acc. 721 Box 22 Highland park Construction and Repairs 1937-1940, folder 4 of 4, photo #73830-4, The Benson Ford Research Center, The Henry Ford.

added on the north-east corner, but has since been removed. Regardless of these changes, the fact that the building was still a usable, productive facility might have been its saving grace.

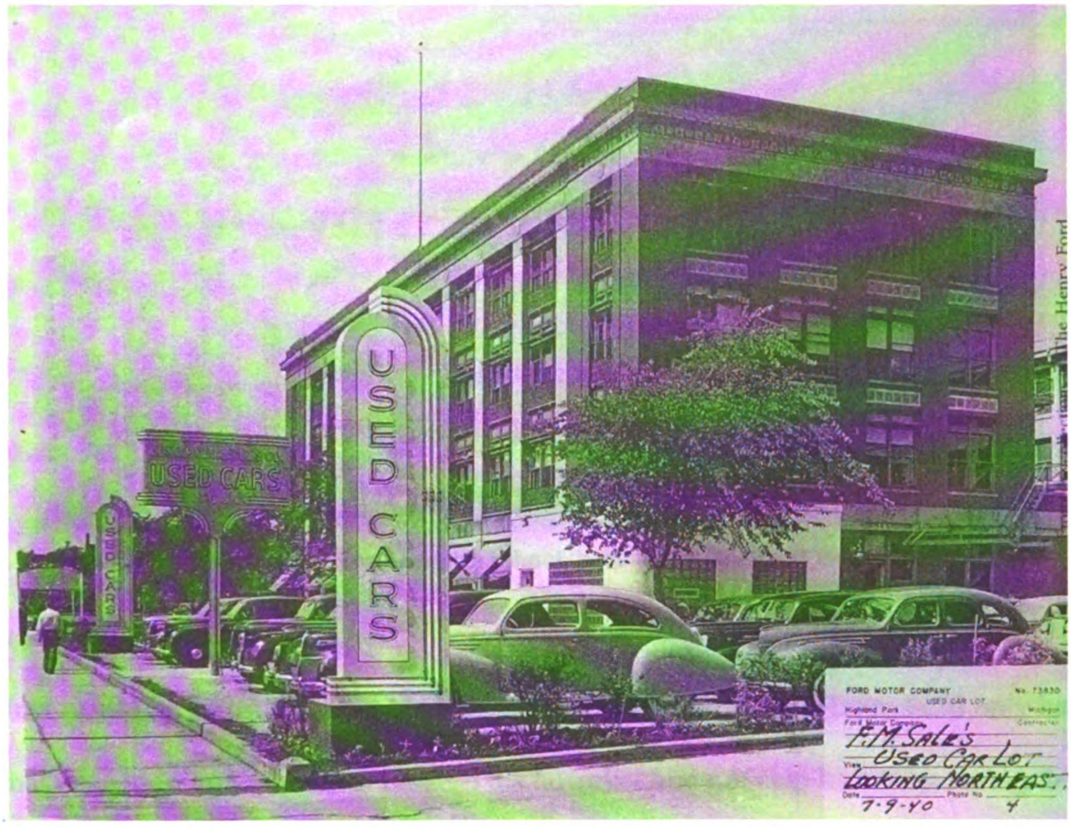



**Figure 4.39 Photo taken in 1940 showing the sales building with used car signs along the front of the building.**

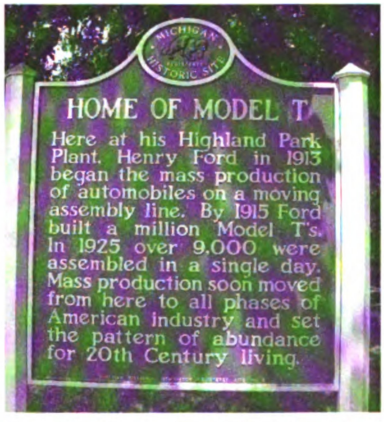



**Figure 4.40 Photo of the historical marker in front of the sale building. Taken by AKJ in June of 2008.**


**Figure 4.41 Photo from the Ford News of the ceremony making the Highland Park complex a Michigan historic site on may 26, 1956.[33]**

[33] Vertical File, Highland Park, The Benson Ford Research Center, The Henry Ford.

# Chapter Five
## Learning English and Buying Fish:
## The Innovative Services Offered to Highland Park Employees

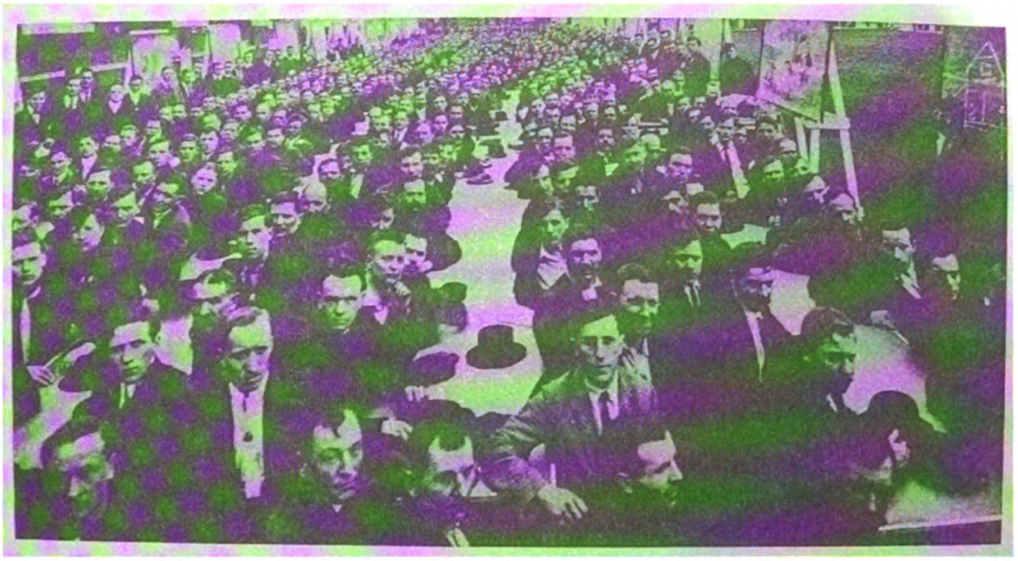


**Figure 5.1 Photo of the Ford English school, held in the Highland Park factory.**

*Education at Highland Park*

Most would be surprised, after his lifetime of great success, that Henry Ford only had a formal education up to the sixth grade. This however, did not stop him from seeing the importance of a good education. Ford's commitment to education would eventually spread to a great number of schools in many different areas, both in America and abroad. His educational experiment would begin directly at his Highland Park factory. Ford's goal was to combine traditional subjects and vocational training. It would take form as the Henry Ford Trade School for Disadvantaged Boys, begun in 1916.

**Figure 5. 2 Photo of the building that housed the Ford Trade School. Behind the building and to the right is the sales building.**

The building the school would be housed in sat directly on Woodward Avenue, next to the original factory building (Figure 5.2).[1] This building was in fact, the oldest on the complex, having been present prior to the building of the original factory. It would eventually be torn down, but information as to when and what its original purpose was has not been forthcoming. The school itself, would be a great success. The curriculum was intended to prepare students for the most demanding industrial jobs within the Ford Motor Company. Students would learn the mechanical arts, a subject close to Ford's own heart, along with drafting, chemistry, physics, and metallurgy.[2] They would also learn the more traditional subjects of History and English, along with bookkeeping. Class work would alternate every two weeks with shop practice, and students were even paid for the work they did, although at a lower wage than their adult counterparts (Figure 5.3).[3] Upon their graduation, students were offered positions within Ford Motor Company, but not all of them chose to work for Ford, and left for other firms. Ford seemed to have no ill feelings towards boys choosing to leave his company, wanting only to give them a better

**Figure 5.3 Students leaving the Ford Trade School after class was let out in May of 1927. The AA factory extension building and sales building can be seen to the right.**

[1] Acc. 721, Box 22, Highland Park Repairs 1937-1940, The Benson Ford Research Center, The Henry Ford.
[2] Bryan, *Beyond the Model T*, 180.
[3] 833-49096, The Benson Ford Research Center, The Henry Ford.

opportunity in life.[4]

By 1927 the trade school had 4,500 students and 150 instructors.[5] Highland Park would provide a blueprint for Ford's other trade schools, from Dearborn, to Georgia, England, and even Brazil. The "Prince of educators", as Ford was called by his friend George Washington Carver, would spend a great deal of his time focused on educational endeavors, possibly even more than his automobile business in his later life. The Trade School, according to historian Douglas Brinkley actually operated at a loss, which was certainly of no concern to the very rich Henry Ford.[6] While Ford rarely ever gave money as charity to organizations, he was by no means shy of financing projects that he deemed worthwhile even if they lost money. In all, the school would graduate eight thousand students, many of which would stay within the Ford Motor Company.[7]

Ford also had an apprentice school for men aged eighteen to thirty. This school offered a program that typically took three years to complete. Students would choose from one of the factory's specialized fields as their focus, allowing them to become skilled tradesmen.[8] The importance of these skills can be seen in Arnold and Faurote's description of workers in Highland Park's skilled trades; "They must be good, they must be experienced, and the better they are and the bigger wage they can earn the more valuable they are to the shop."[9]

Henry Ford's other major educational contributions at Highland Park would happen directly within the walls of his factory. By 1914, Ford's success with the Model T had

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[4] Ibid.
[5] Brinkley, *Wheels for the World*, 367.
[6] Ibid.
[7] Bryan, *Beyond the Model T*, 175.
[8] Harold Hicks, "Reminiscences"(Oral History Project): 140-141, The Benson Ford Research Center, The Henry Ford.
[9] Arnold and Faurote, *Ford Methods*, 41.

lead to great expansion within his company. This translated into the hiring of a massive workforce. Many of these new hires were recent immigrants, at times making up more than one third of his workforce. A great deal of these new immigrant workers could not read or write English and could barely speak it, which compromised their ability to follow orders and work well within the factory. Instead of refusing to hire these people, and certainly due to the need for more workers, the company created accommodations to integrate these workers successfully into the factory. An interesting example can be found in a Ford Motor Company change of address form from Highland Park. The form gives directions in eight different languages.[10] Ford also decided to set up an English school for his workers, where they would learn to read, write, and speak English. Instruction of the English school was carried out by employees with teaching experience. The classes would be held outside working hours and students would attend for an average of six to eight months to complete the course. At its height, enrollment reached 2,200 students representing fifty-five different nations, all taught by 150 instructors.[11] This is an average ratio of 14.7 students per instructor, far better than most public school ratios today. Lessons also included training in United States naturalization requirements. When the student graduated, they were presented with a diploma which was accepted by United States district officials in Detroit, allowing them to receive their first papers without additional examination. Classes often ended with citizenship ceremonies held just for Ford English School graduates.[12] The company not only provided itself with a more efficient and loyal workforce, but allowed many of their employees to gain citizenship and to better integrate into American society.

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[10] Ibid., 59.
[11] Bryan, *Beyond the Model T*, 178.
[12] Ibid.

*Highland Park Medicine*

There is no doubt that working in a turn of the century factory was dangerous. Even with Ford's exceptional safety record for its time, industrial injuries were still common occurrences. Ford set up a hospital and series of first aid stations to aid his injured workers. These stations were small and quite simple, but this was to change as the medical department continued to expand along with the rest of the factory.

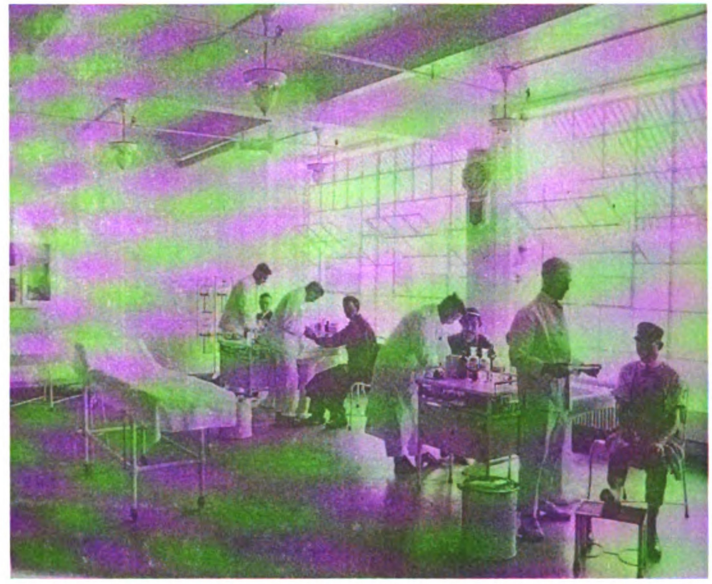

**Figure 5.4 Photo of the Highland Park Medical facility taken in 1916.**

By 1920, it had become a twenty room facility, including an operating room, a six-bed ward, a laboratory, x-ray installation,

two-chair dental office, a pharmacy, dispensary and a large waiting room with attached examination rooms (Figure 5.4).[13] The entire facility was decorated in white and employed over 100 physicians and first-aid men .[14] These positions included surgeon-in chief, Dr. J.E. Mead, as well as operating surgeons, a radiologist, tuberculosis specialist, eye and ear specialist, nose and throat specialist, dermatologist, two dentists, a bacteriologist, two pharmacists, an anesthetist and ninety-six first aid men and medical

[13] Acc. 1660, Box 131, Highland Park Hospitals, 0-3688, The Benson Ford Research Center, The Henry Ford.

[14] Bryan, *Beyond the Model T* , 199.

clerks.[15] The medical clerks were responsible for reporting to the sociological department who would in turn take steps to prevent occupational accidents. They would also investigate more serious incidents, to determine if the worker's finances, home life, or state of mind contributed to the accident.[16] During a typical eight-hour shift in 1917, a first aid station might treat up to two hundred patients for various afflictions. Eye injuries were the most common affliction, averaging more than six-thousand cases per month (Figure 5.5).[17] On average five or six major operations were also performed a month.[18]

**Figure 5.5 Photo of a Highland Park doctor treating a worker with an eye injury.**

Tuberculosis was the most common disease of the time, and as such was not absent at Highland Park. More than 5,000 examinations were conducted in 1916-1917 alone, by lung specialist Dr. M.D. Campbell. Of those examined, 500 were found positive and 250 were labeled suspicious. An entire department, the Medical Transfer Department, was set up for the purpose of transferring workers to new positions due to illness or injury.[19] Tuberculosis patients were assigned to jobs that were dust and smoke free, preferably outside, day-shift jobs. Some of the more severe non-married cases

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[15] Ibid.
[16] Ibid.
[17] Acc. 1660, Box 131, Highland Park Hospitals, 833-223, The Benson Ford Research Center, The Henry Ford.
[18] "Ford Motor Company Medical Organization-1916-1917," Acc. 611, Box 1, The Benson Ford Research Center, The Henry Ford.
[19] Bryan, *Beyond the Model T*, 200.

labeled "lungers" were invited to live at the Ford cottage, or rather Ford sanitarium. The cottage was located near the plant. Workers that were admitted had to follow a strict regiment of work, rest, recreation, and diet. When at work, men completed the outdoor tasks of automobile chassis drivers, doormen, watchmen, and sorters in the outdoor scrap yard. Each case was followed closely by doctors and nurses. They recorded the patient's temperature, weight, and general condition every day. All this was part of a study of tuberculosis's effect on labor. The goal was to determine if a cure could be found for TB patients while they continued to work.[20]

The Highland Park factory hospital would be the first, and nearly the largest of Ford's many industrial medical facilities. Ford would eventually open many such facilities across the United States as well as ones in over thirty other countries.

The Highland Park Medical Department's other major responsibility was to examine newly hired employees. This was done after hiring, not before. It was said that no man would be turned away from the Ford Motor Company because of a medical condition, a rarity among early factories. The following is an account of this process, recorded by Arnold and Faurote in 1915;

> I have been told that all applicants for Ford jobs must be up to a grade under a "military examination" by the Ford surgeons. Nothing could be farther from the truth. The employment agent, who looks applicants over before sending them to the surgeon for examination, said to me that so long as it seemed to him that a man could do work enough to pay overhead charges on the floor space he would occupy, he sent him to the examining surgeon. He quoted Henry Ford saying "We must all live. If a man can make himself of any use at all, put him on, give

[20] Ibid.

him his chance, and if he tries to do the right thing we can find a living for him, anyway." This Ford policy must have given hope, most valuable of all human possessions, to many a despairing brain.[21]

By 1917, there were on file at Highland Park 957 handicapped men, 10 of which were blind, 207 blind in one eye, 37 deaf and 234 with only one foot or leg. Jobs were found for these men based on their affliction, and they were even paid regular wages.[22] One cannot say that Ford was not an equal opportunity employer for his time.

*The Highland Park Commissary*

World War I had several major effects on the Highland Park factory, beyond just war-time production changes. After the end of WWI the United States experienced a period of inflation on household goods. Ford saw an opportunity to again help his workers, while allowing his company to make a profit. This came in the form of the Ford Commissary, officially announced to open the week of December 1, 1919.[23]

The Highland Park commissary would be the first, largest, and longest operating commissary of over a dozen set up by the Ford Motor Company. The commissaries were located everywhere from Michigan's Upper Peninsula to the jungles of Brazil. The commissary's intent was to offer its workers high quality, low cost household goods.

Experimentation in sales was to begin in November of 1919. The first product Ford sold was a shipment of fish ordered from a fishery on the Atlantic coast. Ford purchased bluefish, haddock, and flounder by the boxcar load. A series of three fish sales were held

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[21] Arnold and Faurote, *Ford Methods*, 42..
[22] Bryan, *Beyond the Model T*, 199.
[23] "Company Will Open Store" Ford Man, (December 3, 1919).

along the railroad on Woodward Avenue across from the Highland Park power house. The sale began at nine a.m. and by that time, lines stretching several city blocks long had formed. The sales would continue until well after dark. Some people bought as much as a hundred pounds at a time, able to transport it in their own automobiles. In all, some forty thousand pounds of fish were sold at each sale, making it a tremendous success.[24] With the success of the fish sale, another similar sale was planned. On December 11, 1919 at a temporary site, two truckloads of hogs had arrived, and a cash register and cutting blocks were set up. People began to flock to the site. The best cuts sold at twenty to twenty five cents a pound, and a total of thirty-five thousand pounds of pork was sold.[25]

**Figure 5.6 Customers shopping in the Highland Park commissary.**

The official Highland Park commissary was set up next to the pay office on Manchester Avenue near the corner of Woodward. The commissary system was very simple; buy goods in bulk, and sell them at low prices. The same department that bought raw materials for the factory's assembly operations also bought the goods for the commissary. Due to Ford's large workforce, he could easily sell large quantities of goods, making the system quite successful. Once the Highland Park commissary was permanently

[24] Bryan, *Beyond the Model T*, 213.
[25] Ibid.

established, goods were sold in a production line system (Figure 5.6).[26] This allowed a quick turnover of customers, using a minimal amount of clerks. The first store looked much like Ford's assembly line. It was an aisle fifteen feet wide by one hundred feet long.[27] The commissary was intended for Ford employees only, so a service man was placed at the entrance to check for Ford factory badges. The customer was given a three-part order sheet. One part was for groceries, one for clothing and shoes, and one for drugs and sundries. As customers passed down the isle, they selected goods, which were then handed to them by a series of clerks, who also filled out the price on their order sheets. At the end of the line, they would then pass a cashier, who would add up their bill and take payment. The customer would then use the order sheet as a pass to exit the commissary. Behind the scenes, goods were delivered to the commissary, using a greater number of men to move goods than clerks to deliver them. In total, Ford would set aside 31,260 square feet of floor space for the commissary, and spent $82,740 in equipment and $364,544 in inventory.[28] Despite the large quantities purchased, often by rail or truck, the turnover of goods was astounding. Some products even carried a Ford label, such as coffee, tea, flour, butter, toothpaste, aspirins, cold tablets, mouthwash, and several drugs formulated and produced by Henry Ford Hospital in Detroit.[29] Customers were also able to buy manufacturing by-products of coal such as coke, ammonium sulphate fertilizer, cement from the Rouge plant, coal from Ford mines in Kentucky and West Virginia and charcoal briquettes from Iron Mountain, Michigan. The large amount of coal produced from the Ford mines, more than twice what was needed for operations at the Rouge plant,

[26]0-4128, The Benson Ford Research Center, The Henry Ford.
[27] Ibid., 215.
[28] Ibid.
[29] Ibid.

provided employees in Detroit with a large source of cheap fuel, some 1.5 million tons. Prices were assigned by grade of coal; $9.00 per ton for Nuttalburg (New River Smokeless), $8.00 per ton for Banner Creek (Lump) and $6.75 per ton for Pond Creek (High Volatile). The Ford News provided instructions to its employees on how to burn each type of coal in their home stoves and furnaces. Not only did this surplus coal provide Detroit employees with a cheaper source of fuel, the sales of coal in the commissaries also allowed Ford to keep his mines operational year-round. This allowed a steady pay check for Ford's coal mine employees, rather than being laid-off in the off season like most other mine workers of the time. Because sales of coal were also extended to other Ford commissaries at various other Ford industry complexes outside of Detroit, the mines were able to make a good profit. This in turn, resulted in Ford coal miners receiving a good paycheck that allowed them to live in modern homes, a rarity for most coal miners of the time.

Coke was also available for home use to employees. This byproduct came from operations at the Rouge, and was sold at about half the normal retail price.[30] Another product produced by Ford coal distillation was a light oil which could be added to gasoline to produce a better engine fuel. It was marketed as Ford Benzol and sold at one-hundred and forty gas stations around Detroit, as well as in the Highland Park commissary. Ammonium sulphate was another byproduct, which was produced and marketed as a very effective fertilizer for plants. It was sold not only in Ford's Detroit area commissaries but also at Ford, Lincoln and Fordson Tractor dealers around the country. At the Highland Park commissary, it sold for twenty-five cents for five pounds, forty-five cents for ten pounds, two dollars and ten cents for fifty pounds and seven

[30] Ibid., 216.

dollars and seventy-five cents for 200 pounds. It uses and effectiveness were featured in the Ford News.

Ford's large-scale timber operations in Michigan's Upper Peninsula produced wood waste which was then carbonized and made into briquettes and sold at Ford commissaries for home use (this process is still used to make barbecue charcoal briquettes today). It sold at Highland Park for twenty cents for a ten pound bag and two dollars for a hundred pound bag.[31]

Another highly prized product sold at the Highland Park commissary was Ford flour. The mix of spring and winter wheat was home-grown on Ford's farms (many of which were in south-east Michigan) and ground at the Ford Flour mill right in Dearborn, Michigan. The flour was very well received as being of a high quality.[32] The Ford News even supplied recipes for making home-made bread. The commissary also held baking contests to show the superiority of their flour to other brands. By 1924, Ford had sold seventy-five thousand, twenty-five pound bags of flour in the Highland Park commissary alone.

The Highland Park commissary's peak was to come in 1926, coinciding with some of the largest workforce numbers. Sales totaled at $6,932,076.05; four million in groceries, over two million in meats, and just over one million in dry goods. While providing his employees

**Figure 5.7 Customers buying meat in the Highland Park commissary.**

[31] Ibid., 216-219.
[32] Ibid., 215-216

with high quality, low-price goods, Ford was still able to turn a sizeable sales profit of 3.7 percent in 1926.[33]

If there was a problem with the Highland Park commissary it was that it was too successful. On June 22, 1925, the Ford Motor Company announced in the Ford News that it would only sell goods to Ford employees. Only employees with Ford badges and family members with special identification tags could shop in the commissary. The newspaper reported sales to about six thousand customers daily, selling four thousand loaves of bread, six thousand pounds of butter, thirty barrels of flour, twelve hundred pounds of cheese, one thousand-nine hundred and fifty pounds of coffee and eight tons of sugar (Figure 5.7).[34] They also sold three hundred to eight hundred pairs of shoes and fifteen tons of meat a day.[35] Although business had been restricted to employees only, friends and family of employees often shared identification, allowing a great number of non-employees to take advantage of Ford discounts. By 1926 the commissary's success was so great that the Detroit Retail Merchant's Association gathered on the night of April 4, to protest the Ford commissaries. They felt that the commissaries were stealing a large portion of the association's profits. G.N. Staples, the superintendent of commissaries replied to the crowd that a new plan to restrict sales to Ford employees more tightly, would be devised in a few days. Merchants continued to protest Ford's actions, claiming he was subsidizing his commissary and was actually losing money by selling goods at such low prices. Mr. Liebold, general secretary to Henry Ford, announced that while Ford employees had saved five hundred dollars a year by shopping at the commissary, the company had still made a profit of six percent. He also stated that their books would be

[33] Ibid.
[34] The Ford Industries, The Benson Ford Research Center, The Henry Ford.
[35] Ibid., 219-220.

open to inspection, although a meeting of the retailers on April 20th announced that the books were not yet available. Regardless, the Ford record books from 1924 to 1928 do actually show a profit for the Highland Park commissary of between 2.8 to 4.6 percent with an average of 3.36 percent. This proved that the Ford Motor Company had both saved money for its employees and still made a profit itself.[36]

[36] Ibid., 220-221.

# Conclusion
## Standing at the Bus Stop:
## Highland Park Today

**Figure c.1 The facade of the sales building covered in ivy. Taken by AKJ, June of 2008.**

Highland Park was still used for manufacturing into the 1970's. The Detroit Free Press reported on September 28, 1973 that 500 jobs would be moved over to Highland Park for a trim plant.[1] After the last of the tractor assembly was transferred to Romeo, Michigan in 1973, the plant was to be used as a warehouse, for storage of old company files.

The Highland Park complex of 102 acres and 20 buildings was sold in August of 1981 to a trio of Detroit businessmen; William D. Byron a warehousing executive, Martin Ross, a real estate developer, and Erwin C. Ziegelman, a Detroit lawyer. In an article by the New York Times, a Ford Spokesman was asked the reason for the sale of such a

[1] "500 Jobs to Highland Park Trim Plant" *The Detroit Free Press*, (September 28, 1973), Vertical File, Highland Park, Folder 2 of 2, The Benson Ford Research Center, The Henry Ford.

historically significant plant. He replied by saying, "its a matter of economics".[2] The Ford Motor Company would no longer own the site, but would continue to lease a section of the complex for use as a storage facility for records and equipment. Carts full of files can be seen today through the windows of the still standing sales building on Woodward Avenue. As of October of 1995, 100 people still worked at Highland Park, 21 of which were Ford employees who worked as wheelwrights and riggers as well as security.[3] As of today, the factory's temperature is never let below 55 degrees, to help preserve the company's stored records. The original fire doors and alarms are still in use, although using them could be a challenge, as one fire escape off the sales building has a tree growing through it, and another ends a good 20 feet above the ground.[4]

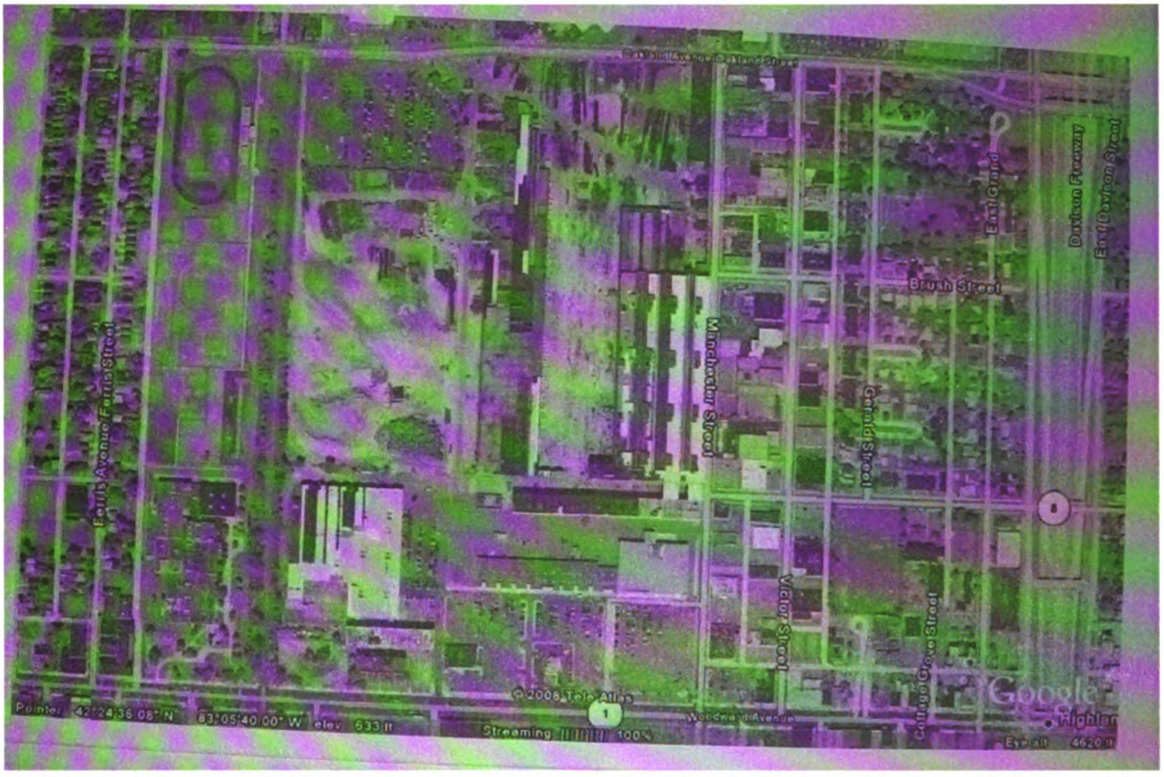


**Figure c.2 Arial photo of the Highland Park Complex today. Courtesy of Google Earth.**

[2] Peterson, "Ford Selling Factory,".
[3] Wilson, "Giant of Industry".
[4] Ibid.

Today, the factory that became the model for industrial complexes around the world has a questionable future. Several ideas have been proposed for the complex. The Detroit Free Press reported on June 17, 1999 that the sales building standing on Woodward Avenue would be renovated and turned into an elementary charter school called the George Washington Carver Academy. The plan was to spend two million dollars to renovate the building under the direction of Detroit architect Nathan Harvey. The plan was ill received by the city of Highland Park, which no doubt, was concerned over the loss of funding to its public schools due to a new charter school.[5] The plan was never seen to fruition. The Detroit Free Press later reported that the academy would be set up in a former Farmer Jack building instead.

While very little of the original factory complex still exists today, it stands as a testament to the great change Henry Ford unleashed on the world. There are very few examples left of these original automobile factories, making the preservation of the few left even more vital. The last several decades have witnessed the end of many of Detroit's original automotive factories. The Dodge Main was demolished in 1980, the Chrysler Jefferson Avenue Plant in 1991, Cadillac's Clark Street building in 1995, and the Packard Plant on East Grand Boulevard is under threat as the city plans to build a greenway at the site.[6] While sites such as houses and skyscrapers are often saved and put on view for the public, factories lack the same prestige given to other structures. Their industrial nature and their sometimes infamous history, have left the sites abandoned and neglected, having become history's troublesome cousin that no one in the family cares to acknowledge.

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[5] Vertical File, Highland Park, Folder 2 of 2, The Benson Ford Research Center, The Henry Ford.
[6] French, "New Industrial Society,".

To look at this complex today is to see a massive industrial structure, with its steel girders, cement walls, wire grid windows and razor wire fences. But if you look closer you will find intricate cornices, beautiful brick masonry, limestone keystones, and paneled wood doors. Its size is overwhelming, its innovation still impressive today. We cannot ignore our history because it may have some faults. The fact is that the early automotive factories such as Highland Park helped to transform our country into the strongest in the world. It should inspire awe and encourage contemplation, none of which it can do if it is gone. To see a photo of this once-mighty factory can never move and awaken the public as much as walking its halls. My hope is to see this structure given the respect other Ford sites have been granted, complete with tours, meticulous care and souvenir shops. As of now, I can only be content with a green National Historic sign hidden beneath some mulberry bushes, and the small child looking up at its massive height while waiting for the bus with his Mother. I wonder if he will one day see what I do, and if his children will ever see this site at all.

**Figure c.3 The corner of the AA extension building. Photo taken by AKJ, June of 2008.**

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